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The Institute of Vitreous Enamellers
The National Ironfounding Employers' Federation
The Welsh Engineers' and Founders' Association
and
The Foundry Trades' Equipment and Supplies Association

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Chemical Analysis

The annual report of the Government Laboratory, issued recently, discloses an amazing range of activities on the part of the Government Chemist and his staff. The substances submitted for analysis during the year, including samples of sea and river water, tobacco, matches, opium, alcoholic liquors, foods, medicines, and metals and alloys used in aircraft construction, clearly demonstrate the versatility of which modern analytical chemistry is capable in safeguarding the interests of the State. Just as in these matters of national service, the importance of analytical control in industry is no longer a controversial topic; the analytical chemist is now an accepted member of the organisation, rendering an essential service in supplying accurate and reliable data to the management. Too often, unfortunately, the analyst is found to be content with his almost monastic existence in the laboratory, caring little for the affairs of the outside world as represented by the factory or foundry. Probably the nature of the work attracts only such men as are content to devote their lives to this painstaking branch of science, which, while calling for the skill of the virtuoso, yet remains but the handmaiden of industry. Many a technical man, having wandered inadvertently into the analytical side of his particular subject, has hastened to find a way out into the wider fields of process control, but for the right type of man there is ample opportunity to develop a certain administrative function based upon his analytical control. It is naturally of no avail for the analyst to content himself with supplying data to others who are quite possibly less competent to interpret and act upon them than he is himself, but with the aid of a little imagination and initiative the training that an analytical chemist has received should form an excellent background for the development of his work as an integral part of his organisation.

On the other side of the picture there is often to be found among foundry executives an appalling inability to interpret the results of chemical analysis. Whatever may be the relative merits of the latter as compared with mechanical tests and fractures, it is only by means of routine analyses that any sound idea can be obtained of the uniformity or fluctuations in the output of castings, and it is thus imperative that the foundry executive should be in a position to appreciate the full meaning and also the limitations of analytical results. A better acquaintance with the principles and methods of analytical chemistry would in many cases lead to a more enlightened outlook in the day-to-day control of the foundry.

Early Castings

An interesting discussion has taken place in a daily contemporary on castings from Sussex furnaces in the days of the Spanish Armada, and used as cannon. It is said, for example, that nearly all the cannon used in the Spanish ships of that date was of Sussex manufacture, and that thousands of these guns were made at the Sussex furnaces and exported, many being smuggled through the harbours at Rye and Shoreham. This forms a singularly early precedent for the export of armaments. One of the main reasons for the popularity of this charcoal iron material was its superb workmanship, combined with the excellent quality of the iron, a combination which is still true of British castings. Since the casting was free from air pockets and blow-holes, the cannon did not burst in firing, as did many of the guns of that period originating in Spain and France.

The Spanish Armada was defeated in 1588. Another fact of interest stresses the extraordinarily long life of cast iron. Queen Elizabeth once sent a parcel of eight pieces of ordnance for the defence of Great Yarmouth, consisting of "demi-culverins of cast iron, mounted and furnished, sacres of cast iron, in like sort mounted." These pieces of ordnance were actually found to be in good order at an inspection which took place in 1765, nearly two centuries later. Not only is this a tribute to the quality of the metal, but also to the quality of the cannon, for it is unlikely that the guns would have been kept so long unless they were capable of holding their own, as firing pieces, with their successors. Apart from the iron cannon, there were five brass cannon paraded at the same inspection, two of which are said to have been acquired from Cadiz. Thus a good slice of English history could be written in terms of castings. Mr. J. E. Hurst's researches into the history of Sheffield ironfounding, which have been published in our last two issues, fully demonstrate the truth of this.

Correspondence

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

The Foundry of Ford Motor Company

To the Editor of The Foundry Trade Journal.

Sir,—My collaborator in the preparation of the above Paper, Mr. J. N. Burns, has just telephoned to tell me that I "dropped a brick" in my part of what has been a most pleasant and interesting undertaking. In reference to the burning of the accumulations of paper at the vibrating screen end of the sand-preparing plant, these originate neither as chocolate cartons nor chewing-gum wrappers, but result from the very commendable practice of using paper for ensuring cleanliness of the mould cavity.—Yours, etc.,

Vincent C. Faulkner.

70, Carlton Avenue, Harrow.
October 23, 1934.

Whiting Medal Award

Dr. Arnold Lenz, who at the annual convention of the American Foundrymen's Association will be awarded the Whiting Medal for his conspicuous contributions to the foundry industry, is a practical foundryman who worked his way up through the jobs of moulder, coremaker, and melter, since he started out as an apprentice over 30 years ago. It is particularly fitting that at this convention, which is held in conjunction with the Fifth International Foundry Congress, the medal should be presented to a man who came to America at the age of 18 from Germany, determined to succeed in his adopted land. Dr. Lenz is now assistant manufacturing manager in charge of the Flint, Bay City and Saginaw plants of the Chevrolet Motor Company.

Born in Hauingen, Germany, in 1888, Arnold Lenz was apprenticed at the age of 14 to the firm of Sarsin, Staehlin & Company, Haagen. Displaying even in those early years the determination which has made him one of the foremost founders in America, he attended evening classes during the four years of his apprenticeship. When he came to America, in 1906, he spent two years working his way through New York State Normal School at Fredonia, New York.

Dr. Lenz was recently elected President and chairman of the Board of Regents of General Motors Institute. For his contributions to the development of the foundry industry, and especially for his work on the production of large quantities of automotive castings, Dr. Lenz was given the honorary degree of Doctor of Engineering by the University of Aachen, Germany.

Broken Hill Proprietary Company

The marked increase in demand for iron and steel products in Australia during the past two years is reflected in figures just issued by the Broken Hill Proprietary Company, which during recent years has produced about 75 per cent. of the Commonwealth's total output of pig-iron and steel ingots. Production of pig-iron by the Broken Hill Company, which decreased from 330,800 tons in the year ended May 31, 1929, to 153,563 tons in the year ended May 31, 1932, recovered to 262,714 tons during the year ended May 31, 1933, and expanded further to 346,752 tons in the year ended May 31, 1934. The company's production of steel ingots was 374,000 tons in the year ended May 31, 1929, but dropped in the following year to 195,183 tons. The improved demand for steel products brought the production figures up to 320,931 tons in the year ended May 31, 1933, and to 414,242 tons in the year ended May 31, 1934.

Mr. John Willcocks, J.P., head of the firm of Willcocks & Son, engineers and ironfounders, of the Dial Foundry, Buckfastleigh, died recently.

District Presidents.—No. 7

LINCOLN SECTION OF THE INSTITUTE OF BRITISH FOUNDRYMEN

Mr. Tom Mather, President of the Lincoln Section of the Institute of British Foundrymen, started his foundry career in 1894 with Messrs. Robey & Company, engineers, Lincoln, and, except for an interlude of one year with Messrs. Hadfields, Limited, he remained with this company for several years. After a period, in charge of the cylinder department at Messrs. Clayton & Shuttleworth, Limited, of Lincoln, he took charge of the foundry of Messrs. William

Mr. Tom Mather.

Foster & Company, Limited, engineers, Lincoln. Mr. Mather is a graduate of the McLain system, having taken the foundry course in mixing iron, semi-steel, and cupola practice.

Mr. Mather has been Vice-President of the Branch since it was formed, and is the first native to become President of the Lincoln section.

Book Review

Lubricating Oil Tests and their Significance, by J. E. Southcombe. Published by Germ Lubricants, Limited, 735, Salisbury House, Finsbury Circus, London, E.C.2. Price 2s. 6d.

The issue of a third revised edition is an indication of the deserved popularity of this small book. Containing a short account of the essentials of the properties and testing of lubricating oils, the book fills a need often experienced by engineers and others whose training has not included a course on oil technology. The tests described are those which are necessary to obtain a reliable guide as to the probable behaviour of an oil in service or, alternatively, to provide data to explain behaviour already experienced. The new edition contains additions dealing with cylinder wear in automobiles, consumption of oil in internal-combustion engines, and recent developments in refining lubricating oils. The book is seasoned with a definite flavouring of the particular quality of lubricating oil in which the author is directly interested, but this gives an added interest to the general matter which will well repay digestion by those interested in lubricating-oil problems.

F. K. N.

Random Shots

These are the days of commodity development associations, and following the lead given by copper, the tin people are now aiming at making their product more popular. "Marksman" has no authority at all for stating that this idea is taking hold everywhere, and that where tin and copper have gone, other things will follow. Now that present-day conditions demand the dismissal of our telephone lines underground, the timber people are getting seriously alarmed about their poles (this has no connection with the European situation!), and may shortly be advertising these for other purposes. "Marksman" imagines it would be something like this. "Do your doors stick in damp weather? A telegraph pole will banish all trouble." And the door into the bargain, unless we are much mistaken! Or what about this? "Runner beans are up the pole in no time. Try our de luxe model, complete with lightning conductor and rope ladder." That would give Jones his quietus when he bragged about his tomatoes, wouldn't it?

* * *

This push on the part of the timber people may well alarm the iron and steel fraternity, who will be looking round for fresh worlds to conquer. "Marksman" suggests the following. "Christmas is the time for rejoisting in your home; do it with steel." Then, under situations vacant, "If you do not mind a hard billet, we have plenty in stock." For cyclists: "Spills can be avoided; we will tell you how to cast yourself." Household linen: "Good strong sheets, fully annealed and guaranteed not to buckle. You really won't be able to leave your bed." For pastrycooks: "Tee pieces are delicious." To gardeners: "The blooms we shall sell you will defy the winter frosts." Under hardware: "Fishplates are wanted every Friday; try them in steel." And finally, as a kind of general ultimatum to those who are still hesitating to give their business to the ferrous industry: "Stolen pleasures are sweetest, therefore STEEL."

* * *

"Marksman" imagines that the high prices of the precious metals must be making things difficult for the jewellers, although the mineowners themselves are reaping rich rewards. The silversmiths may be obliged to extend the scope of their activities and get busy on a few sidelines. As, for instance: "Clouds will come, so why not let us line them for you?" or "Time eludes you, but you will get time all right if you take our silver." Gold certainly stands at a very inflated price, and this must be a "soar" point with the jewellery people. They might try to turn an honest penny by an incursion into the realms of hairdressing, to wit: "Ladies! Come to us with your golden tresses; surely they are worth a bob?" Perhaps an appeal to the housewives would not go unanswered, as for example: "The gilt is off your gingerbread, madam? Though innocent of the crime, we specialise in guilt and will gladly assist you."

* * *

The railways, having lost ground sadly during these post-war years, are making noble and successful efforts to win their way back into public esteem. Much good work has been done, but "Marksman," with great deference, suggests a slogan or two for these good friends of the iron and steel industries. "Travelling is no longer a torture. True, your luggage is put on the rack, but you may stretch yourself in comfort." And another, "Our rails are steel, but not stolen; our 'heads' are swell, but not swollen." Yet one more, "We have no truck with inefficiency."

* * *

Just one word about a trade which "Marksman" believes is busy and prosperous. It really is not true that the electrical people have executed a *volte face* and are preparing special currents for Christmas. "Marksman."

Steel Castings*

By W. H. Hatfield, D.Met. (Director of the Brown-Firth Research Laboratories, Sheffield

The object of these interchange Papers is that of endeavouring to obtain some comparison as regards the outlook, methods and results of practice in our respective countries. The author's very interesting and pleasant experiences during visits to the United States of America caused him to accept with much appreciation the invitation to present this Paper.

Foundries in Great Britain are fortunate in several respects. They have highly-skilled workmen with long traditions in the trade, and they have an excellent supply of shrewd and practical managers and foremen. The demands upon British foundries differ in measure from the demands upon many American establishments, principally in the greater diversity of design of casting and the larger number of oddment orders, which factors call for great skill and resource on the part of both staff and workmen. An individual foundry is frequently called upon to produce a wide range of castings; castings for turbine construction, railway castings, dredging plant, ship's castings, castings for agriculture machinery, for chemical plant, pump and valve parts, not to mention the vast range of general engineering castings. Such a wide range demands the use of many different steels, with necessary metallurgical and metallographic knowledge on the part of the management.

The art of making steel castings has reached a very high standard. It is, of course, well known and appreciated that, if everything is subordinated to the production of a perfect steel *ingot*, *i.e.*, simplicity in design of mould and feeder head, control of casting temperature, speed of teeming, as well as the provision of perfectly "killed" liquid steel, even so, perfection is difficult of attainment. When, therefore, the designer sits down in his drawing office and presumes to prepare drawings of the finished shapes in which the steel has to do service, and then expects the foundrymen to cast these parts into their final shapes, he can only be saved from trouble by the art of the foundryman. The designer always asks much of the foundryman, and sometimes asks too much. No one should presume to design steel castings unless he has had adequate foundry experience. However, whatever the complexity of design or changes in section, there may be in the casting required, the foundryman is expected to, and usually does, produce a reasonably good casting by arranging the suitable number and form and position of gates and feeders, suitable position of mould, the correct nature and condition of the refractories used for mould and cores.

Research

The need for research in steelfounding has long been appreciated in Great Britain, and the larger companies have their own research laboratories; the Brown-Firth Research Laboratories, which the author has the pleasure of directing, having been in full operation so long ago as 1908. Of later years, however, co-operation in problems affecting the whole industry has developed, and for some few years now the Steel Castings Committee, a technical committee of the British Federation of Iron and Steel Manufacturers, has been doing very useful work, its first Report having been issued in 1933 (Iron and Steel Institute). Whilst the steelfounder is very successful in most instances, it is appreciated that his practice is even yet necessarily based upon an empirical handling of a large number of acquired data in the light of practical experience in the foundry. The accumulation of exact knowledge as years pass is gradually changing over the "art" into the "science" of steelfounding. Research into many of the obvious problems is not easy owing to the difficulty of experimenting as regards the physical chemistry of steelmaking, and the determination of physical and mechanical values at the high temperatures involved. Much progress is, however, being made.

Fig. 1.—Impeller Casting of Stainless Steel Shown Sectioned in Fig. 2.

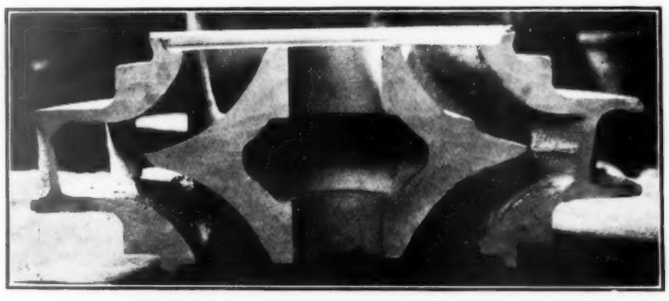

Fig. 2.—2 ft. 6 in. Impeller (Stainless Steel).

One interesting problem, as yet unsolved, is the apparent fact that fluidity would at times appear to be influenced by the physical chemistry of steelmaking, and be, in measure, independent of actual temperature. No adequate means of determining fluidity against an absolute standard has yet been devised, whilst the effect of temperature on the true viscosity of molten steels has not been done. The effect of methods of deoxidation and of the oxygen content are now being studied in a promising manner, both at Sheffield University and at the National Physical Laboratory. Invaluable work is proceeding on behalf of the Steel Castings Committee at Woolwich Research Laboratories on the strength of steels subsequent to freezing. The properties and applications of various refractory materials as moulding material are now having attention on lines not hitherto attempted. In this short Paper, however, the author can best deal with present steelfounding practice.

Manufacture of the Steel

Whilst the open-hearth process is used, particularly for the larger castings, the electric processes are being extensively applied, particularly for the smaller castings. Considerable tonnage is also being produced from small converters. As regards the smallest of castings, the

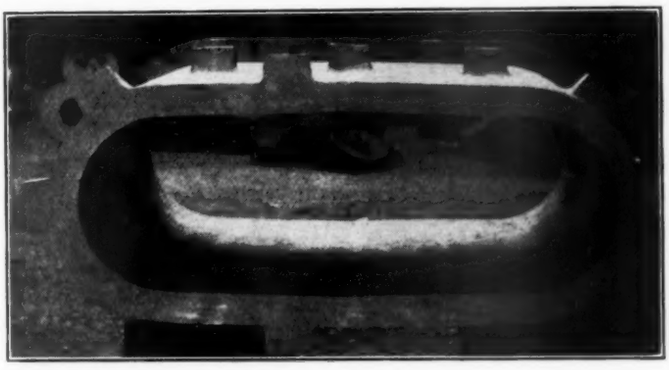

Fig. 3.—Transverse Section of 7½-ton Cast Vessel (Mild Steel).

* Annual Exchange Paper presented on behalf of the Institute of British Foundrymen to the American Foundrymen's Association.

crucible process is still regarded as effective. The process employed is largely determined by the composition of the steel and the nature of the castings. Except to state that, whatever the process, the steel must be of the dead killed or piping type, it is unnecessary to deal further with that aspect of the matter on this occasion.

Sands, etc.

The essential properties required are refractoriness and porosity. As regards preparation, correct grading and control of moisture content are essential. Systematic handling is the only means for ensuring consistent results, which demand uniform qualities, both chemically and mechanically. The use of a suitable proportion of old sand is not only feasible but very satisfactory and economical, but the practice in this respect must be, and is, carefully planned and recorded.

Fig. 4.—Section of Gear-Wheel Blank (0.40 Carbon Steel).

From this point of view, a foundry working on repetition work, producing large quantities of castings to a particular pattern, has a great advantage, since the preparation of the sand can be systematised on a much simpler scheme than in a foundry which produces castings of miscellaneous types. At the same time, the foundry of the latter type has greater facilities for studying the response of different mixtures to the varying factors, and is therefore better able to make a suitable selection when a new type of casting is to be made. Permeability and strength data are given in various publications and need not be discussed here. Whilst such data are of great value, it is necessary in all cases to obtain direct practical experience as to the suitability of any moulding material for particular purposes.

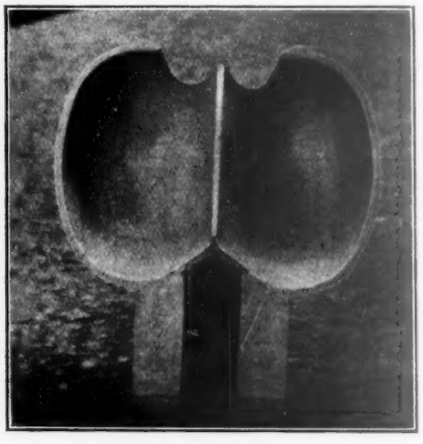

Fig. 5.—Pelton Wheel Bucket (Stainless Steel).

The cost of sand per ton of finished castings is naturally an important factor in the cost of the casting, and therefore necessitates a careful study of market prices of the available sands.

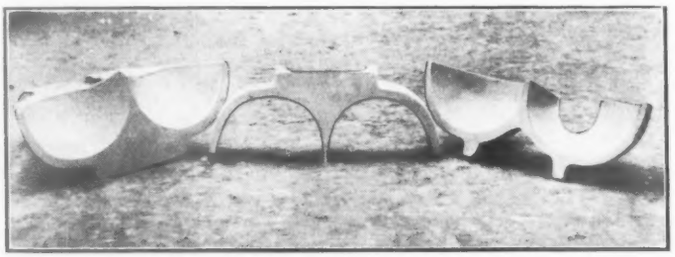

Fig. 6.—Sections of the Above.

The variables in castings, which affect the properties required in the sand, are such items as deep or shallow moulds, moulds with large surface area in the upper portion, simple or intricate form of mould, moulds for light or heavy sections, as well as the quality of steel to be cast. Light castings can usually be satisfactorily made in a naturally-bonded sand, such as Yorkshire or Belgian yellow sand. The resulting floor sand is satisfactorily reconditioned and added in substantial proportions, say 20 to 40 per cent., according to the work on hand. Such sands are fairly uniform and consistent with about 15 mins. milling, and the moisture content, suitably controlled for green- or dry-sand work, and are found to give good all-round results. Additions of washed silica sand have the advantage of increasing permeability and refractoriness. It is sometimes found to be an advantage to employ a green sand for the lower part of a mould and a dried-oil sand for the upper portion.

The influence of the type of steel used for the castings on the requirements is illustrated by comparing ordinary mild steel either with high-manganese steel or high-chromium steel. Manganese steel has a great erosive action and flows easily, whilst chromium steels tend to be somewhat sluggish.

"Compos" are in use in special cases, the clay and other constituents being introduced in various forms and proportion, crushed silica bricks, old pots, common clay, china clay, together with coke dust. The aim, whether with sand or compo, is to obtain a material which at high temperature and load pressure has sufficient refractoriness to retain its shape and not become fused, and is at the same time permeable.

Cores

Cores must have the property of readily collapsing after the steel is solid, as, otherwise, pulling stresses are set up by the contraction in the metal around them immediately after freezing. Mild steel solidifies quickly, and the collapse of the core, due to contraction, must take place without delay if hot pulls are to be prevented. Silica sand of medium grain, bonded with a suitable oil, serves well for this purpose, but the degree of baking requires careful control. Some stiffening of the core to help it to retain its shape may be necessary in some cases, and an addition of resin to the mix may be employed for this purpose.

Moulding

The moulder's art is the determining factor in obtaining consistently good castings. Long years of careful training are necessary in the case of moulders and many of them have an astonishing intuition based upon long practical experience and observation. It is particularly important to reproduce the correct degree of ramming. Whilst for repetition work, machine-moulding, properly controlled, eliminates some of the variables due to the human element, the special type of steelfoundry work with which the author is chiefly connected does not lend itself to any great degree to mass production by machine methods.

The planning as regards fixing of cores, provision for venting should be done jointly between those responsible for the different phases of the job. Free passage of air expelled from the sand by expansion effects must obviously be provided in an outward direction. The permeability of the backing sand is equally important to that of the facing sand. This is obviously of special importance in green-sand work due to the heavier generation of steam. The correct use of brackets calls for discrimination, and should be decided beforehand with full appreciation of the features of the particular casting, and the same remarks apply equally well to core irons.

The strength of the mould and mould-box acquires a greater significance when dealing with castings having large vertical dimensions. The "ferrostatic" pressure due to the head of fluid metal, being nearly eight times that for the same head of water, quickly reaches serious values. With large castings, and castings of tubular shape, it is no uncommon thing to have a depth of 30 ft. of metal to take care of, whilst in the case of castings of large horizontal projected area, although the fluid pressure per unit area may be not unduly large, the total upward pressure on the mould covers reaches colossal values and demands heavy weighting suitably distributed; any movement in the parts of the mould during casting readily wrecks a costly casting.

Perhaps the most serious question in the foundry in the production of sound castings is that of satisfactorily arranging for free contraction during cooling, particularly in the early stages just after casting. There are two separate factors entering into the phenomenon of "pulled" castings: (1) the strength of the refractories whose natural thermal contraction is almost negligible in comparison with that of the

Fig. 7.—Dredger Bucket (Manganese Steel, 13.0 per cent. Mn) after Sectioning.

steel, and which are generally still heating up and expanding whilst the steel is solidifying and contracting, and (2) the unequal cooling of the casting causing some parts to be contracting much in advance of others which may be at a more tender stage as regards temperature.

Whilst item (1) is largely a question of the correct choice of sands, item (2) brings in the question of design of the casting itself. The amount of contraction of large steel castings is very substantial. A usual allowance for carbon-steel castings is $\frac{5}{32}$ in. to $\frac{7}{32}$ in. per ft., and this leads to an amount on a ship's casting—say on stem pieces or stern frames of 30 ft. to 40 ft. length—of approaching 8 in. It is necessary in such cases so to construct the mould that it can be liberated at different stages to prevent it from pulling itself to pieces. The most vulnerable positions are those which are last to cool, such as thick portions or the junctions of cross ribs. The practice of adding thin brackets to protect such positions is successful in some cases, but, as already mentioned, requires judicious application as, if overdone, it may be the cause of trouble instead of the cure.

The use of "chills" to accelerate the cooling of certain portions of the casting is advantageous in many cases but, like the use of brackets, requires careful judgment in its application. It has been shown that the danger of hot pulls may be transferred from a certain position in a casting, which would otherwise have been vulnerable as being the last to freeze and suffering at that time from contraction effects applying tension from the neighbouring solid material. If, however, the effect is merely to transfer the pull to another position equally likely to suffer, no advantage results.

As regards the later period during cooling, it is a curious fact that cracks appear liable to develop at a temperature not far removed from the "blue brittle" range, say 300 deg. C. in plain carbon steel. These are clearly due to the production of internal stress due to differential cooling of the mass, and, whereas the material down to a temperature of a dull-red heat—say 500 to 550 deg. C.—has some capacity for yielding under such stresses, this yielding property is known to be present to a much smaller degree round about 300 deg. C., or at lower temperatures, and this presumably accounts for the apparent critical nature of the "blue" range of temperature. For special qualities of steel, this critical range may occur at higher temperatures. A suitable control of cooling conditions, and correct interposition of heat-treatment, is the method generally employed to overcome the danger of "cold" cracks. Frequently much can be done by small modifications in design to reduce both hot-pulling and cold-cracking dangers.

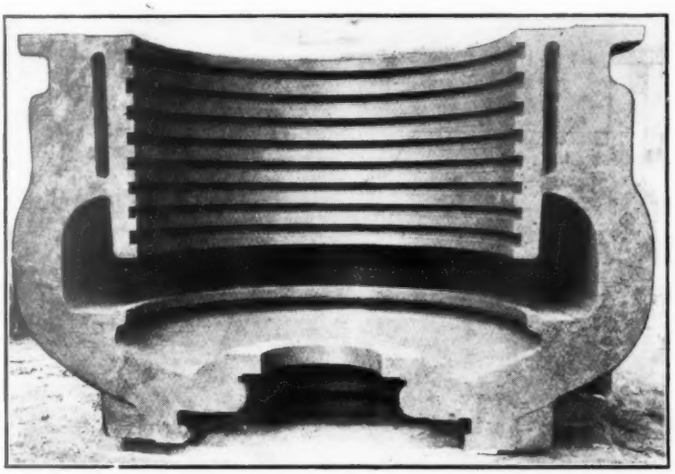

Fig. 8.—Turbine Casing. Upper Half Mild Steel.

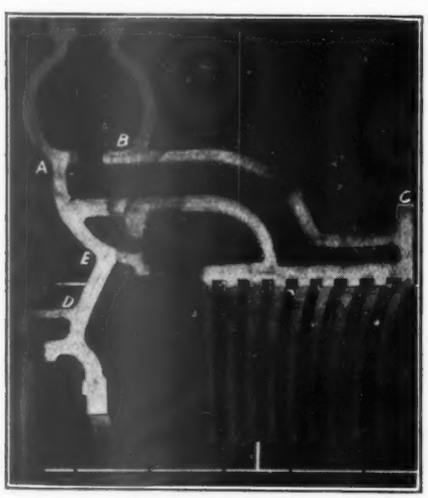

Fig. 9.—Turbine Casing Section.

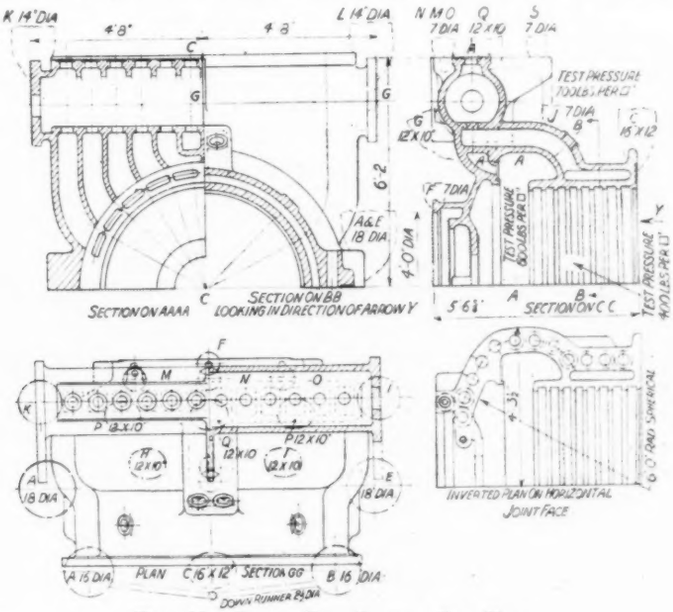

Fig. 10.—Steam End Casing, Top Half.

Casting Conditions

Little need be said about the actual casting operations. The transfer of metal from furnace to mould requires adequate plant for manipulation. Avoidance of the inclusion of slag and foreign matter in the mould is obviously necessary, and the need for the employment of sufficiently high metal temperature to give the necessary fluidity without undue superheat is readily appreciated by those in charge of casting operations. The molten metal should be run into the mould as quickly as is consistent with a proper flow and adequate control.

Feeder Heads

The choice of the number, form, and spacing of the position of feeder heads of a casting is the great responsibility in the production of the majority of steel castings if a satisfactory solid product is to be obtained. The freezing of any section naturally proceeds from the outer surface inwards, and the inner portion thus has to suffer the combined liquid and solid contraction after the outer solidified portions are more or less set in position. The natural tendency to form a "cavity" must be met by having an adjacent supply of hot fluid metal which can run into the desired position in sufficient quantity to prevent the formation of a cavity. All feeder heads should be applied in such positions that no contracting inner part of the casting is denuded of metal. The thinner portions naturally tend to draw from the thicker portions, and junctions of ribs and cross-members which lag slightly behind the neighbouring parts in cooling are liable to have their centres "sucked."

Feeder heads must be sufficiently numerous to feed all points where such a tendency may exist. Modifications in design can frequently remove danger points, since thin and thick sections in juxtaposition are naturally not ideal from the foundry point of view, however desirable they may be as regards the purpose of the designer. Clear judgment and appreciation of the natural course of flow of the metal in the moulds and of the order of freezing is required. In a composite casting, each section generally demands separate feeding.

The suitable form and size of feeder heads are best appreciated by sectioning examples of different types. Several cases are indicated later in the Paper. In addition to having sufficient "body" of metal, they must be such that the central pipe or cavity which forms in them does not extend into the actual casting. Long thin heads fail in this way, and actually bring added weakness by freezing across near the outside, and thus causing a deep-seated inner and discontinu-

(*Continued on page* 254.)

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The Philadelphia International Foundry Congress

From Our Special Correspondent.

On board M.S. "Lafayette," somewhere near Newfoundland, October 8, 1934.

These notes are being written under some difficulty, as the boat is endeavouring to stand on end and it keeps trying each end alternately. This is the sixth day since leaving Plymouth, and only on two of those days has the sea been smooth; during the remainder of the time it has been distinctly rough. Last night there was a real Atlantic gale, through which the writer slept soundly, and knew nothing about it until he was informed this morning.

Fortunately, the Foundry Congress party is coming through the rough weather fairly well. We have not had much sickness, and some of the party, namely, Messrs. Smith, Delport, Jeans and Hurren, seem incapable of being upset by anything. Whatever happens, they seem to enjoy it.

There are eighteen members of the Foundry Congress party in this boat, including the seven British members who joined at Plymouth. The Bristol party consists of Mr. James Smith, President of the Ironfounding Employers' Federation; Mr. Harold Jeans, chairman of directors of The Foundry Trade Journal, and Mrs. Jeans; Mr. Spence-Thomas, Vice-President of the Iron and Steel Institute; Mr. E. H. Hurren, of the Coventry Malleable & Aluminium Company; Mr. V. Delport, European representative of the American Foundrymen's Association; and Mr. Tom Makemson, secretary of the Institute of British Foundrymen. The Continental members, who joined at Havre, and had mainly retired for the night when the British party came aboard in the small hours of Wednesday morning, consist of Mr. Leonard, President of the Belgian Association; Mr. Brizon, Vice-President of the French Association, and Madame Brizon; seven other French delegates, and a Spanish foundryman. There is also an Italian party of about 36 travelling by the "Rex." This party is led by Dr. Vanzetti and Mr. Norsa.

Just as we left Plymouth we received the following telegram from Mr. Roy Stubbs, President of the Institute of British Foundrymen:—

"Please convey to all members British delegation felicitations, best wishes for enjoyable voyage, and successful convention.—Stubbs. President, I.B.F."

On Sunday we replied to Mr. Stubbs by ocean letter, as follows:—

"British party in mid-Atlantic thank you for good wishes. All well.—Makemson."

The ocean letter was transmitted by radio to the "Paris," which is eastward bound, and will be put ashore at Plymouth on Friday next.

Mr. Delport also sent a radiogram to our colleagues on the "Rex," and received the following radiogram in reply:—

"Delport, 'Lafayette.'—Thanks. Italian friends heartily reciprocate greetings.—Vanzetti."

The "Lafayette's" Engine Room

Thanks to the good offices of Mr. Delport, the Congress party on the "Lafayette" has made the acquaintance of the captain and several officers, and has been accorded a few privileges, which are much appreciated. On Friday we inspected the engine room, power house and refrigerating plant, and walked along the shaft tunnels. The propelling machinery consists of four Diesel engines, two of 4,500 h.p. each and two of 4,750 h.p. each, a total h.p. of 18,500. Each engine drives a propeller shaft at 150 r.p.m., and each of the four propellers is about 12 ft. in diameter. There are five Diesel-driven generators in the power house, three of 700 kw. each and two of 500 kw. each. There is also a steam boiler, oil fired, for hot-water supply. Most of the machinery is of French manufacture, some is German, while some of the specialised auxiliary machinery is British. For example, we observed Reavell air compressors driven by W. H. Allen's motors. We also inspected the kitchens, the bakery and other service departments.

Modern Accommodation

The "Lafayette" is a very modern ship, and has been in service about three years. Her appointments are all that can be desired—roomy cabins, each with private shower bath and telephone, beautiful public rooms with very modern decorations, cooking equal to the very best hotels, and courteous and willing service.

On Saturday, the captain entertained us all at a little party in his rooms. Yesterday, being Sunday, opened with Mass (there is a daily Mass also). In the afternoon there was an exhibition of boxing, wrestling and fencing by members of the crew. The ship's page boys took part in the light-weight boxing, and bashed each other about in fine style, whilst we discovered that our

The British Delegation to the Philadelphia Foundry Congress.

On the steps are Mr. Harold Jeans, Chairman of the Foundry Trade Journal; Mr. V. Delport, European Representative of the American Foundrymen's Association. In front of them are Mr. Spence Thomas, Vice-President of the Iron and Steel Institute; Mr. James Smith, President of the National Ironfounding Employers' Federation; Mr. T. Makemson, Secretary of the Institute of British Foundrymen and Mr. F. H. Hurren of Coventry Malleable Company.

wine steward holds a Belgian army championship in fencing. Each afternoon we have "talkies" to watch, and, of course, a concert and dance each night. The most energetic member of the party is M. Vicaire, one of the leaders of the French party, who samples all the sports each day and yet seems unable to work off his surplus energy.

I am sorry, Mr. Editor, that I cannot write you any more now, because the ship has decided to try and turn over sideways, and the paper keeps sliding about the writing table.

October 10.

We were due in New York this morning, but, owing to the bad weather, we are several hours late, and we will not arrive at the Quarantine Station until night. In consequence, we shall probably lie up all night and go ashore tomorrow morning. The weather now is perfect. The sea is calm and there is bright sunshine.

As it was expected that last night would be the last night aboard, the usual captain's dinner was held. There was a special menu, even more wonderful than the menus to which we have become accustomed, and it was arranged that the dinner would be followed by a special concert and a cabaret. Just as dinner commenced, we received the news of the assassination of King Alexander and M. Barthou, and the entertainments were immediately cancelled.

A Bouquet for Delport

Ever since we left London the busiest member of our party has been Mr. Delport, and it is obvious that he has been very busy for many months past. He is constantly looking after all kinds of little details connected with the trip and studying our individual "kinks." He has obtained for us numerous little concessions, and he is now interviewing every member of the party in order to fix up each individual with works visits suited to his particular needs, so that each one may receive the maximum benefit from the trip. We are all very much indebted to him.

In spite of several days of rough weather, the voyage has been a happy one, but we are all anxious to land and commence our strenuous and full programme in the United States. The delay in arriving is disappointing, but we have the rather morbid consolation of learning by wireless that other boats even bigger than ours are arriving at New York a day late.

Steel Castings

(*Continued from page* 253.)

ous pipe. It will be appreciated that in a steel ingot, where conditions are favourable, a reasonable weight of feeding head is very necessary. In steel castings, even as much as 40 to 50 per cent. weight of feeding heads may be necessary, according to the form of casting.

Mention has already been made of "Contraction" effects and the advantages where possible of hot stripping. As soon as possible after stripping, loose sand should be removed from the casting and it should be placed in the annealing furnace.

Examples of Castings

The state of the "art" can best be judged by sectioning a variety of castings. The castings examined have been taken from the steel foundry operated by the company with which the author is associated, and in each case it must be said that the production is the result of considerable experience on the part of the foundry staff and operatives. Impellers are difficult castings to make, but in Figs. 1 and 2 will be found a photograph of one cast in stainless steel and also a view after sectioning, which shows that the feeding has been successfully accomplished. Fig. 3 shows a 7½-ton cast mild-steel vessel after sectioning transversely at a point about one-third of its length. In Fig. 4 is shown the result of sectioning a 0.40 per cent. carbon rotary cast steel gear blank, a particularly difficult job to cast sound.

Figs. 5 and 6 represent a stainless steel pelton wheel bucket before and after sectioning. In this case the changes in section presented a most difficult task from the point of view of overcoming local shrinkage defects. Fig. 7 indicates the freedom from shrinkage effects obtained in manganese steel dredger-bucket practice, after testing and sectioning.

Lastly, in Fig. 8 is shown a turbine casing cast in mild steel, and in this instance might be used to discuss the technique of the foundry which is employed to ensure soundness in such complex and difficult castings.

This was a turbine steam-end casing (top half), with inner chamber 5 ft. 5 in. dia. and external dimension 5 ft. 6¾ in. by 9 ft. 4 in. horizontally and depth 6 ft. 2 in. The net weight as delivered after rough machining was just over 13 tons. The general form as well as details is given in the four drawings shown in Fig. 10. It will be seen that the inner chamber is connected with the upper horizontal valve chest by a number of distributed steam passages, and that there are various cavities (giving the equivalent of a double wall) fed by steam. The bottom and end flanges are incorporated in the casting, as well as several projecting inner portions. Stiffening ribs are attached at various points.

(*To be concluded.*)

The Foundry of Ford Motor Company at Dagenham

By Vincent C. Faulkner and J. N. Burns

(*Concluded from page* 240.)

At the end of the moulding unit, opposite to the backing-sand-preparing plant, is a second one for mixing facing sand. There are 20 hoppers filled by the main sand-distributing belt, beneath which are 19 moulding machines, leaving the twentieth hopper for the provision of sand to the facing-sand-preparing plant. Each hopper, which, though tapered, has two sides in the vertical plane, terminates in a hand-operated clam shell-type closure, and in the case of the one feeding the facing-sand plant, fills a measuring box gauged to contain 2½ cub. ft. of sand. This quantity is fed into a paddle mixer of the left- and right-hand screw type. Discharge is effected through the base of the machine at its centre. Bentonite, coal dust and new sharp silica sand are added in predetermined quantities, and the whole batch is milled for 1 min. By means of a short length of elevator buckets, the sand is fed into a double vibrating screen, the upper one of which is of 1-in. and the lower of ½-in. mesh. It falls through a shute to a scraper conveyor to fill hoppers situated at the side of the moulding machines.

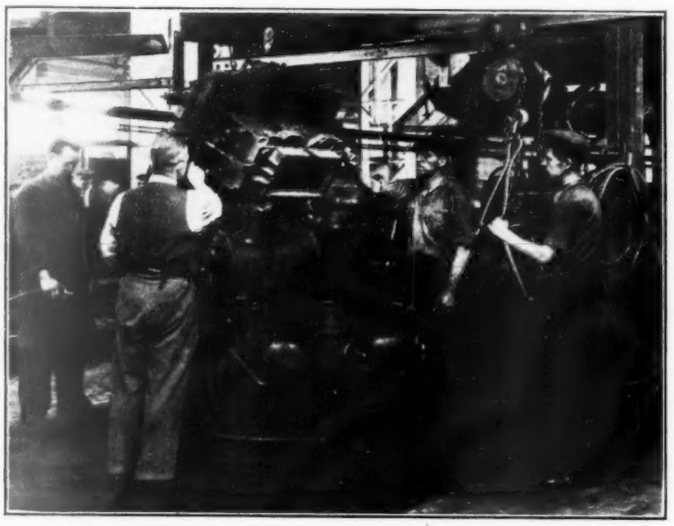

Fig. 24.—Moulding a Large Transmission Housing.

A typical job made on this moulding unit is a transmission housing, weighing 290 lbs. (Fig. 24) before fettling. It is about 18-in. dia. by 3 ft. long, and necessitates a 10-in. lift for stripping. The bottom half and one half-core is made in green sand, whilst the other half-core is in baked oil-sand core. The green-sand core is jolted and struck off, and the dry-sand core is added; over this is placed the bottom box and board, and the whole is clamped and rolled over. The cores arrive on trays suspended from a chain conveyor. Small gantry chain blocks of ½- to 1-ton lifting capacity remove the moulds from the machine to the pendulum mould conveyor. This conveyor is 600 ft. long, and is actuated by two drives, interchangeable and geared and driven by a 15-h.p. motor. The pendulums are spaced at 6-ft. centres. It travels at speeds ranging from 14 to 21 ft. per min. Metal arrives in ½-ton ladles (Fig. 25) suspended from a monorail, which gives a 4-ft. pouring length. Smaller jobs are cast up from 60-lb. hand-shanks suspended from a subsidiary monorail. After being cast up, the moulds enter a cooling tunnel, which is 280 ft. long, and is also common to the No. 2 moulding unit. This tunnel is generously supplied with suction pipes leading to fans (Fig. 23). On arrival at the shake-out, the box parts for the tractor transmission housing castings are returned by the pendulum conveyor, together with the clamps, whilst all other boxes return to the moulders on an 18-in. slat conveyor. This type of moulding unit usually handles five jobs at a maximum, and requires ten machines.

No. 2 Moulding Unit

This system, it will be recalled, handles the cylinder blocks and pistons for the smaller type of automobiles. Both backing- and facing-sand plants are duplicates of those already described. Instead of 20 hoppers, however, the No. 2 system has ten, of which five are in use. This is because there are incorporated within the system a pair of Sandslingers (Fig. 26), served by turntables. One of the turntables is engaged upon the making of bottom parts, using a hand roll-over type of machine, and the other the top parts by means of hand-stripping machines. Sand from the hoppers falls on to an inclined belt conveyor, which feeds each stationary type of Sandslinger. Each plant makes 105 half-moulds per hour. For proper synchronising, there has been installed within this system a continuous platform conveyor (Fig. 27), running between 35-ft. centres. This conveyor is not shown in Fig. 15, but is positioned between the turntable and the end of the pouring monorail and spanned by the baked-core conveyor. Thus, a certain amount of latitude is given for assembling and gauging before placing the closed mould on to the pendulum conveyor. Without such an arrangement congestion could occur at the pouring station, and probably a number of drags would not be complete with copes.

The Nos. 3 and 4 Moulding Units

These are devoted to the manufacture of the numerous small castings used in the make-up of an automobile. There is a double row of twenty moulding machines, forty in all, served by a common sand plant by means of breeches hoppers. Most of the machines are set at 10-ft. centres, but some are reduced to 6 ft. 8 in. Normally, 18 machines will be tackling about nine jobs. Most of the machines are of the jar-squeeze stripping type, but there is also a pair of jolt and roll-over machines; all of them are operated by compressed air. The moulds are taken away by a pendulum conveyor, which is more closely spaced at 4-ft. centres than those serving the larger moulding units, because of the smaller type of work, which is more rapidly handled. All the liquid iron is hand-shanked (Fig. 28). For the provision of facing sand for the smaller circular jobs a mixer of the type usually installed for oil-core sand mixing is used.

Fig. 25.—Most of the Moulds made on the No. 1 System are Poured from Monorail Suspended Ladles.

New Sand

New sand arrives in railway wagons, which are tipped into a pit at the North side of the foundry, shown in Fig. 29. This pit has sloping sides and feeds a hopper, the bottom of which

is formed by a reciprocating conveyor. This in turn feeds a 65-ft. high-bucket elevator, which discharges on to a belt conveyor. This delivers the sand to storage bins on what is termed the high line. Underneath the moulding-sand bins is a 24-in. belt conveyor (Fig. 30) delivering to a reversible-belt conveyor, which in turn delivers the new moulding sand as required to any of the three moulding-sand-preparing systems by ploughing-off to shutes leading to the spillage conveyors. The storage bins also handle the incoming core sand, which is passed through a drying plant prior to delivery to the core-sand mixers.

Fig. 26.—Two Sandslingers are Incorporated in the No. 2 System.

Fig. 27.—A Synchronising Conveyor installed within the No. 2 Moulding Unit.

Core Making

There are two core shops situated on the ground floor immediately beneath the core-sand-mixing balcony. On this balcony are mixers which are duplicates of those used for facing-sand preparation. They take about 2½ cub. ft. and mix by the operation of right- and left-hand paddles. Silica sand flows from the storage hopper into a measurer which is emptied into a wheeled bogey, designed for easy transport and tipping direct into the mixer. The mixture is made-up from silica sand, linseed oil and flour. In the case of No. 1 coreshop, the mixer discharges into another type of bogey, which fills a number of shutes which terminate a few inches above, twelve 6-ft. dia. coremakers' circular tables. Level with the surfaces of some of these tables (Fig. 31) are mounted two small Ford knee-operated jolting machines, having a 2-ft. by 1-ft. table and worked from an 80 lbs. air line. In addition, there are a few small jolt roll-over machines for the heavy tractor cores, and a horizontal core-blowing machine. Circulating around all the tables is the green-core pendulum conveyor (Fig. 32), which is fitted with an anti-vibration device, consisting of an assembly of rubber and springs. The conveyor passes two double-sectioned vertical coke-oven gas-fired core ovens, where they are transferred, baked and again returned to the same green-core conveyor for delivery to the core-dressing benches.

The activities of this department include a well-equipped core-wire reclaiming shop, equipped with modern machinery for cutting, bending and straightening wires of a very wide range of gauges. After drying the cores are dressed and inspected, and they are transferred to a tray conveyor, indicated in Fig. 15, which feeds the various moulding stations.

The stoves, which at any given moment contain 38 pendulums in each section, are automatically controlled at 480 to 500 deg. Fah. (250 to 260 deg. C.). The speed of the conveyor is such that the cores remain in the stove for 1 to 4½ hrs. This speed can be varied from 4 in. to 18 in. per min. by the operation of a variable-speed reducer. The stoves are 60 ft. high by 18 ft. long by 10 ft. wide, and each section is fired by three burners controlled by a special regulator.

No. 2 Coreshop

Probably the most important component made in this section is a barrel core, though others, such as tractor transmission housings, are also manufactured. An apron conveyor situated beneath a hopper delivers predetermined quantities of oil-sand mixture to a stationary sand-slinger, which fills a four-part cast-iron corebox, placed on a hand-operated turntable for bringing the box beneath the impeller head. This arrangement makes 130 cores per hr. This, or indeed any other method of ramming, is unlikely regularly to provide a satisfactory core without further treatment. The method adopted at Ford Motor Company is to pass the core beneath a series of air presses (Fig. 33), the first of which inserts a forked wedge so as to compress the sand under the bearings. Under the next, two

Fig. 28.—Two Monorails allow of the Easy Transference of Metal for Hand-Shanking.

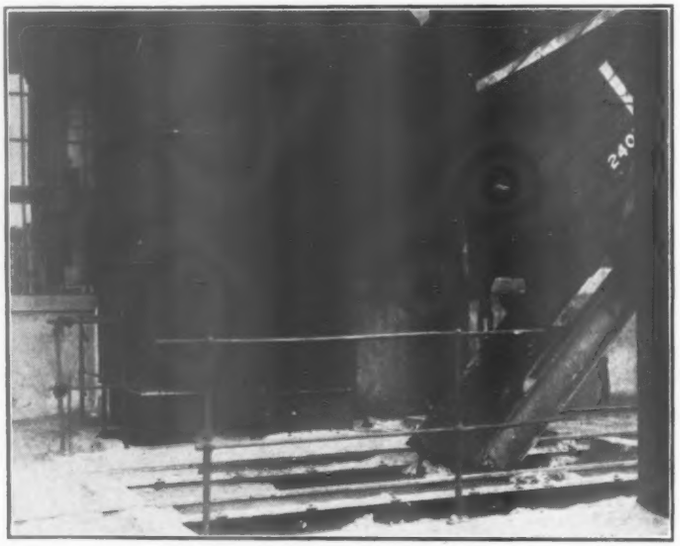

Fig. 29.—New Sand arriving in Railway Trucks is Automatically Fed into a Pit having a Reciprocating Conveyor as its Base.

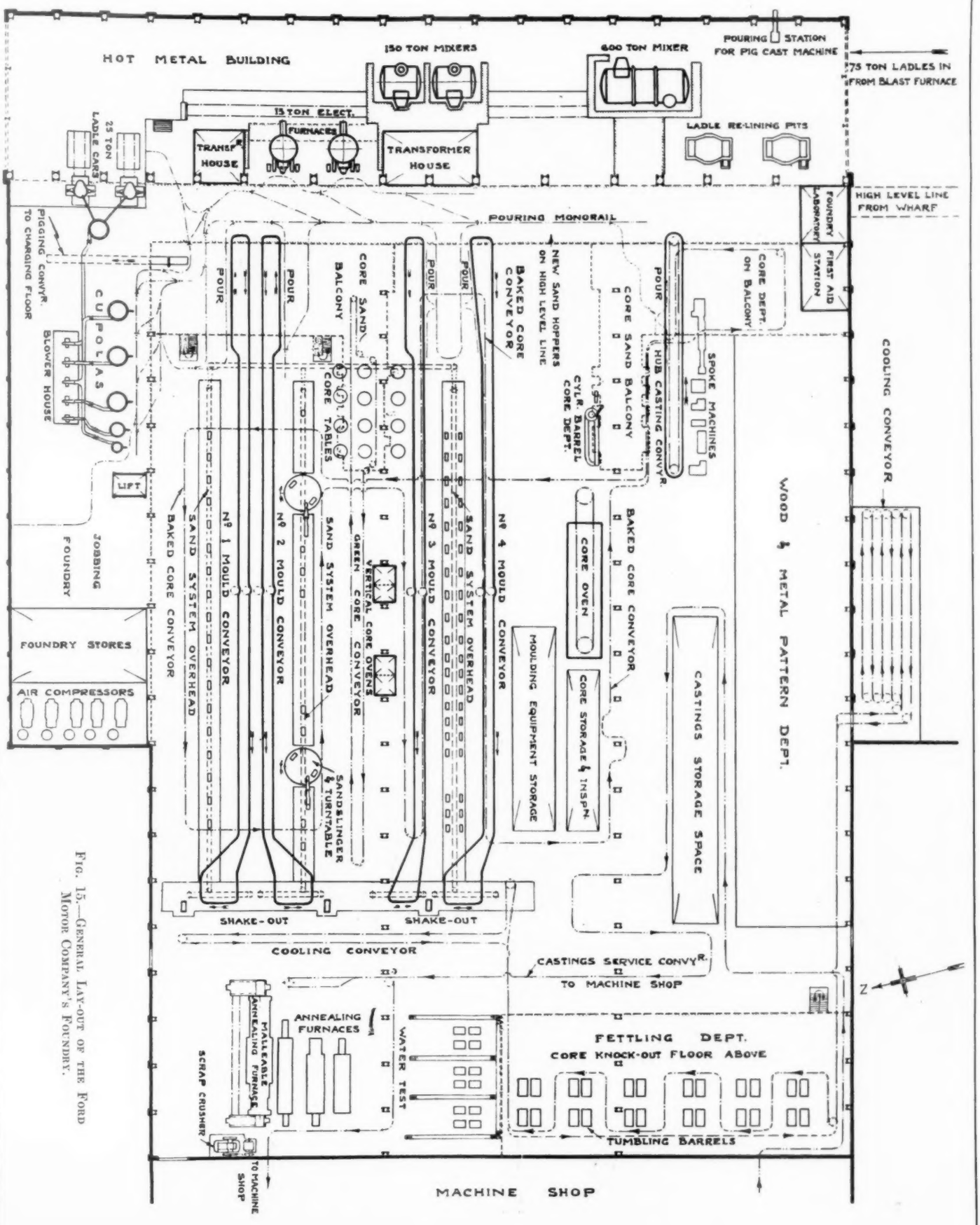

Fig. 15.—General Lay-out of the Ford Motor Company's Foundry.

Fig. 30.—Showing the New-Sand Conveyor, Rotary Drying Stoves for Core Sand and Hoppers.

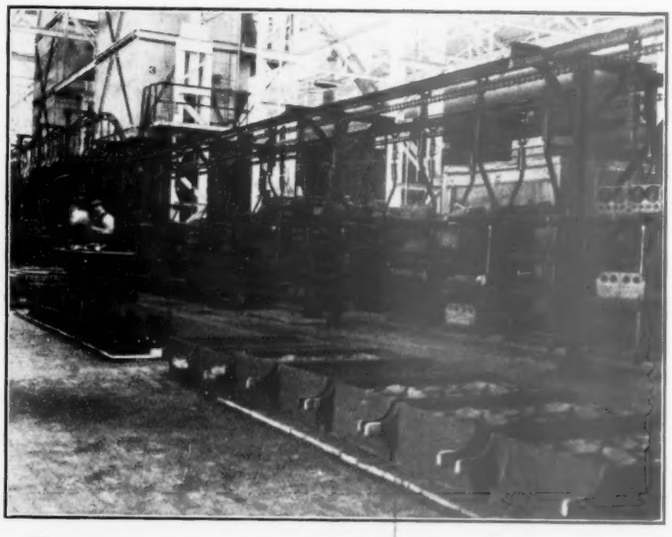

Fig. 32.—The Green-Core Pendulum Conveyor.

Fig. 33.—Air Presses are used for making the Barrel Cores.

Fig. 31.—The No. 1 Coreshop receives its Sand from centrally-disposed Hoppers placed above the Circular Benches.

Fig. 34.—Rotary Dip Fixture for Black-washing Barrel Cores.

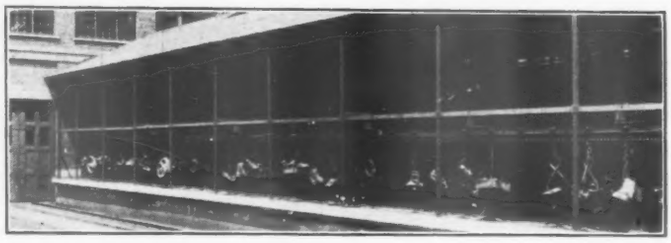

Fig. 37.—The Cooling Conveyor is Half-a-mile Long, and leaves the Foundry Building for a Length of 800 ft.

tubes bore out the vent holes. The third press inserts two arbour pipes and presses them home. The next press butt rams and the core is then struck off. Four holes are then bored, after which the mould is again struck off and rolled over on to the carrier, upon which the core is stripped and fin is removed. The portion that is later to be uppermost in the mould is dusted with a proprietary parting powder to prevent the core-wash adhering to this part during the next process of dipping. This is accomplished on a rotary dip fixture, shown in Fig. 34, from which it will be noticed that the wash is raised to the core. For drying, the cores are placed on the trays of a continuous conveyor which passes through a gas-fired air-circulating stove having eight burners on one side and four on the other. A slat conveyor takes the cores to storage, after which they are thoroughly inspected and gauged before placing on the baked core conveyor for delivery to No. 2 system.

The cores for the large transmission housings (Fig. 35) are made on a roll-over machine and dried in the horizontal stoves with the barrel cores. East of No. 2 core, situated on a balcony, the cylinder water-jacket cores are dressed, assembled, dipped in core wash and baked in gas-fired ovens before being placed on the baked core conveyor.

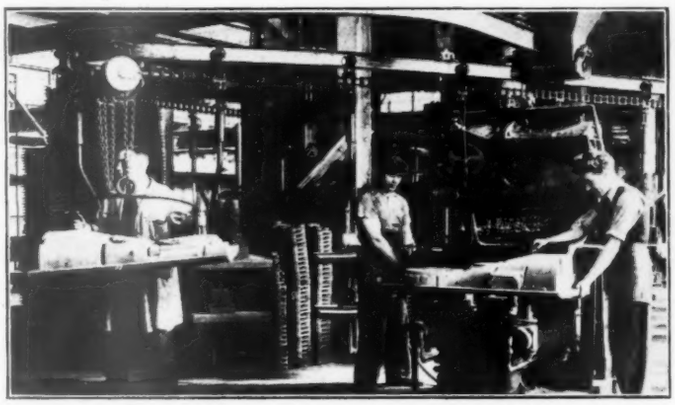

Fig. 35.—Transmission Housing Cores are made on Roll-over Machines.

In addition to the four moulding conveyors, there is a roundabout running between 100-ft. centres, for making tractor rear-wheel hubs (Fig. 36), consisting of circular fixtures attached to a chain. The spokes arrive at flat bars; the ends are bent over, punched, sheared and pickled in dilute sulphuric acid. The bars are picked up by a conveyor with spring clips and the end of the spoke to enter the hub is passed through a tin bath. The spokes are set by jigs into special four-part moulding boxes.

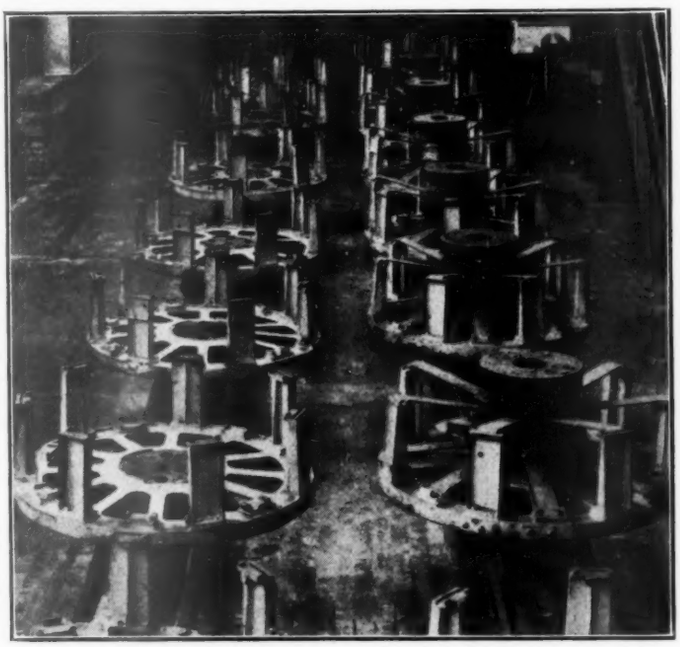

Fig. 36.—Roundabout for making Tractor Rear-Wheel Hubs.

Fettling

The cooling conveyor (Fig. 37) consists of a chain carrying at short intervals hooks of various types and sizes upon which to suspend the castings. It is half a mile long, and of this length 800 ft. are outside the foundry. It passes by all the shake-outs, and before passing to the main cooling section, a gang of men detach any loose sand still adhering. On its re-entry it wends its way through a series of shot-blast rooms where the work is so organised that the castings neglected by the first operator are tackled by the second, or left for a third or even a fourth. These are of a well-known make, and blast pressure at 80 lbs. is used. It next passes by the fettling benches on the ground floor (Fig. 38), where the smaller ones are cleaned by rumbling in barrels. There are eighteen of these, twelve being 6½ ft. long by 4 ft. dia. The larger castings are fettled by hand. There is a battery of 20 snagging machines, all properly equipped with dust-extraction apparatus. In this department there is a close inspection, including hydraulic-pressure testing. Finally, the castings are placed on a delivery conveyor (Fig. 39) which winds through the whole of the machine shops and acts as a casting stores.

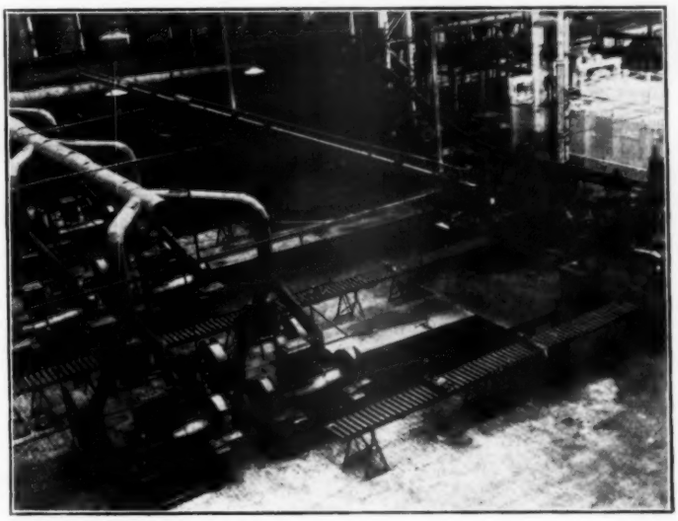

Fig. 38.—General View of the Fettling Shop.

Conclusions

By the divisions of its activities into a number of well-defined sections, the Ford foundry represents an outstanding example of a manufacturing unit lending itself to intensive technical control. Should defective castings occur of any one type, the cause can be traced to its source with a minimum of expenditure of time and trouble. Under the conditions prevailing, it is usually possible to stop production to find the cause and to recommence manufacture within 45 min. During this period, the analysis, the

(*Concluded on page* 260.)

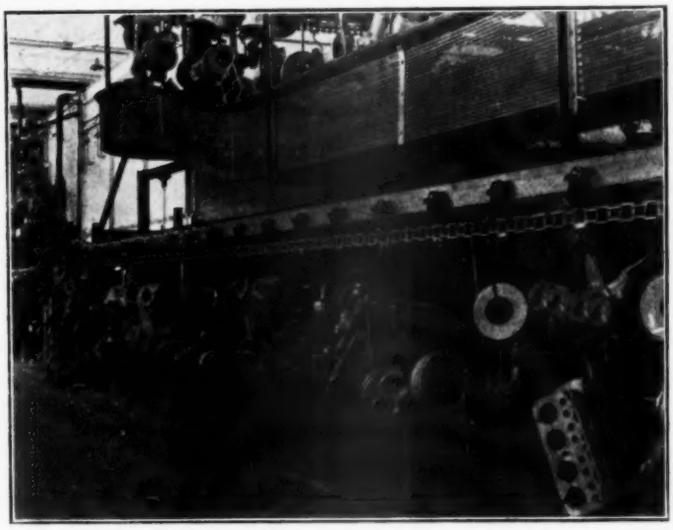

Fig. 39.—Castings-delivery Conveyor.

XUM

Agricultural Implement Foundry Visited

EAST MIDLANDS BRANCH OPENS WINTER SESSION

The East Midlands Branch of the Institute of British Foundrymen opened its winter session recently, when between 50 and 60 members took advantage of the invitation to visit the works of Messrs. Bamfords, Limited, agricultural engineers, Uttoxeter. The members were welcomed by Mr. Bamford, managing director of the firm, and were conducted over the works by Mr. Bamford's two nephews and Mr. F. G. Butters, foundry manager, who is a prominent member of the East Midlands Branch.

The firm are to be congratulated upon the arrangements made for the visit. Each party moved off in a different direction, accompanied by a guide, who was fully conversant with the particular section of the business being shown. The visit round this large works, which covers some 30 acres, was to a time schedule, and, at given points, parties met and exchanged guides, so that every section of the visit was conducted by a specialist in that particular sphere. The guides were most obliging in describing in detail all operations of the making and use of the huge variety of farm implements, pumps, petrol engines, Diesel engines, etc., for which this firm has a world-wide reputation.

The foundry section was personally conducted by Mr. Butters, and showed remarkable castings and plant lay-out for the production of castings for their widely diverse lines. The writer understood from Mr. Butters that the firm have upwards of 20,000 patterns in work, according to the seasonal requirements of the agricultural implement industry. The foundry, set in the midst of a purely agricultural district, has to draw its labour from the farm-labouring type, and they are trained to floor, plate and machine moulding to a remarkable proficiency. The foundry is well equipped with machinery, most of which is made by Messrs. Bamfords in their own works. Sand is served to the foundry by one of the latest-type Simpson mixers as shown in Fig. 1. The firm grinds its own coal dust in a "Bamford" grain-crushing machine, driven by a "Bamford" Diesel engine, and the extraordinarily smooth and clean castings produced from unblacked moulds testify to the success of this equipment.

One shop is equipped with power-squeeze moulding machines entirely operated by girls, and the firm's foresight in this shop is to be commended, as one noticed that all the moulding boxes were designed of light section for easy manipulation by female labour.

The foundries are equipped with three cupolas of 24 in., 30 in. and 44 in. inside diameters, which are set on the railway sidings for immediate handling of materials from truck to cupola, and it was interesting to note the simple yet efficient method of mechanical charging shown in Fig. 2. Mr. Butters said this charging system, even on the small cupola, had given no difficulties.

The firm is fully equipped with machine shops, forge, etc., for the complete manufacture of its supplies, the woodworking section in particular being equipped for the handling of timber from the tree to the finished article. At the close of the visit the party were entertained to tea by Messrs. Bamfords at Elke's Café, Uttoxeter.

Vote of Thanks

The Branch-President, MR. A. E. PEACE, said it was very pleasing indeed to find the works so conveniently arranged for the visit. He was greatly impressed by the charging arrangements of the cupolas.

MR. P. A. RUSSELL said it gave him great pleasure to propose this vote of thanks for the hospitality and excellence of the arrangements of the visit. It was a unique experience to visit a foundry of this class. One obtained a new outlook on light castings of this nature, so different from that obtained when visiting the

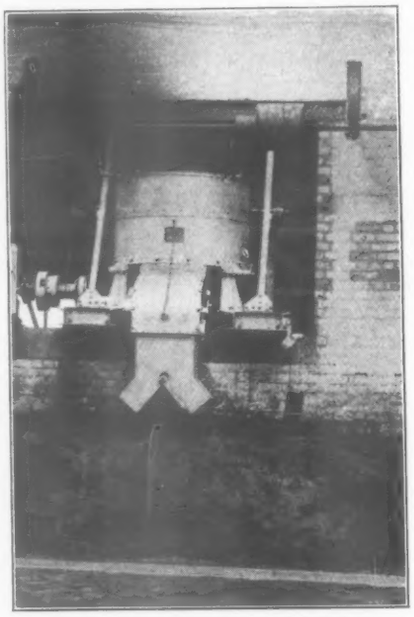

FIG. 1.—THE SAND-PREPARING PLANT INSTALLED IN THE WORKS OF MESSRS. BAMFORDS, LIMITED, UTTOXETER.

"heavy" foundries. The moulding-machine arrangements were very efficient. The firm had mechanisation, but had not carried it too far. He thought on light castings it was uneconomic to have too much mechanisation. He was greatly struck by the area of the works. He had very

FIG. 2.—THE CUPOLA BAY, SHOWING AUTOMATIC CHARGING APPARATUS.

great pleasure in extending thanks to Mr. Bamford, and his nephews, and to Mr. Butters. The East Midlands Branch looked upon Mr. Butters with a proprietary air and were very pleased to see the work he was doing.

MR. H. BUNTING, Vice-President, seconding, said he was sure all would agree that it had been a very instructive and interesting afternoon. There were not many who would not have been surprised by what they had seen. One of the things he was interested in was the foundry manager, Mr. Butters, because he (Mr. Bunting) was responsible for the bad habits of Mr. Butters, and some of his good ones, as Mr. Butters received his apprenticeship training under his personal supervision.

Another point to be commented upon was the quality of the skin finish of the castings. He had seen castings of prominently advertised firms that were no better, and many that were much below the standard of Messrs. Bamfords. It was a credit to the firm.

The vote was received with continuous applause.

Host's Reply

MR. BAMFORD, in response, said he was delighted to hear that this visit had been interesting and that something had been seen out of the ordinary. His firm had started more than 70 years ago in a very modest way, making things necessary for life, that is, pumps for drawing water. With the rise of Burton-on-Trent the pump trade declined, and they went on to further necessities of life, namely, agricultural implements. They had seen, he said, the multiplicity of machinery that this industry involved. In their case there were little opportunities of "mass" production. They had what he would call "flexible" production, and much depended upon the ability of his men to change as the seasons changed. With regard to Mr. Bunting's remarks on 100 per cent. good castings, he used to think that was nearly the case until they embarked upon the petrol and Diesel engines, when they had a very bad experience, but to-day they had a very high percentage of good castings. He said they made a great use of chills in the engine castings, although they had salesmen telling them that so-and-so irons would eliminate chills. He had found chills very successful for chilling liners to a degree that they could just be machined.

The Foundry of Ford Motor Company at Dagenham

(*Concluded from page* 259.)

casting temperature, the nature of mould and core sands and moulding technique can be checked and any variation from standard practice traced and corrected. Herein is the major benefit to be derived from the institution of mechanisation, as the reputation of the finished car could be impaired through lack of control in the earliest stages of the manufacturing processes.

This ideal of close technical control to ensure quality is inculcated in the mind of every scholar studying at the Ford school. The students, as they are passed through the various departments, have it continually impressed upon them how the scientific principles they learn in the schoolroom are applied to control manufacturing conditions for the maintenance and amelioration of quality.

Finally, the authors wish very sincerely to acknowledge the courtesy of the Ford Motor Company in granting permission and affording every facility for the presenting of the data included in this Paper.

Diamond Wheel for Grinding Carbides

The Carborundum Company, N.Y., has developed a new diamond wheel for shaping and conditioning of Carboloy, Firthite, Vascoloy-Ramet, Cormet, Widia and other hard cemented carbides used for turning, boring and other cutting tools. Grinding is done wet, water or a non-alkaline solution being employed.—"The Iron Age."

XUM

Allied Traders and the Institute

Mr. G. T. LUNT'S PLEA

Members of the Birmingham, Coventry and West Midlands Branch of the Institute of British Foundrymen reassembled at the James Watt Memorial Institute, Birmingham, on October 5, when Mr. G. T. Lunt delivered his presidential address.

Mr. Lunt recalled that when he was asked to become the senior Vice-President of the Branch the proposer, in putting his name forward, commented on the fact that in Mr. J. G. Pearce the Branch had had a technical and scientific man as its President. Mr. Pearce was followed in the chair by Mr. E. J. Lewis, a practical foundryman. In him (Mr. Lunt), the proposer said, they would have a President representing the commercial side.

"You might have inferred," Mr. Lunt continued, "that having first taken a course in scientific metallurgy, you would then be given practical instruction in the art of ironfounding. Having mastered that branch, I should come along to instruct you in the art or science of turning your knowledge to commercial use. I think, however, that the correct inference to draw from those remarks is that the Institute of British Foundrymen draws its membership from persons of all grades, and from all branches of the foundry and allied industries.

This line of thought led me to study more closely the Charter of the Institute, and it is interesting to note that among the objects for which it was formed are the following:—

(1) To promote the intellectual welfare of its members by periodical meetings for reading and discussing scientific Papers on subjects connected with the foundry and allied industries.

(2) To collect and distribute information on the science and art of foundry work and allied subjects.

(3) To conduct researches into the science and technology of producing, casting and working metals.

(4) To organise systems of education for members.

These objects are very wide and embrace all the technical aspects of the industry, but are not too wide if the subject is to be dealt with properly. So far as I am able to judge, the Institute has been very well conducted and its officers and councils have year by year carefully kept its objects in view and seen that none of its stated objects has been neglected. I need not here enlarge on the work of the Institute, but perhaps I may mention two activities which will do much to justify the work of the Institute and raise its status. I refer to the exceptionally useful research work of the Technical Committees and the inauguration of the Degree Course in Ironfounding at Sheffield University. As regards the work of the Technical Committees, this meeting will have an opportunity later in the evening of discussing the Report of the Grey Iron Sub-Committee as presented at the Manchester Conference, and Mr. P. A. Russell, the convener of the Committee has very kindly come over from Leicester to introduce the Report.

Concerning the Degree Course in Founding at Sheffield University, I consider that this is a great step towards raising the status of the skilled foundry executive to the level of the professions, such as, for instance, the doctor or dentist. What is more, the efforts of the Institute towards bringing it about, and the publicity from it, have greatly increased the power and usefulness of the Institute of British Foundrymen.

Carrying on, as it does, work of widely differing character, but all having a bearing on some aspect of the foundry trade, the Institute includes among its members men engaged in all branches of the industry and of widely different qualifications, ranging from the humblest apprentice to the larger employer of labour. The fact that the Institute is supported by such a large variety of individuals and provides facilities for all these to discuss matters of interest to them, is in itself a great tribute to the work of the Institute. What is more, it is, in my opinion, one of the chief reasons for its success. In a society whose members include such widely different categories as moulders, foremen, foundry proprietors, foundry salesmen, supplier salesmen, metallurgists, scientific professors, etc., each grade maybe with a mentality peculiar to its training, it would be strange, indeed, if occasions did not arise when opinions differed on the relative importance of these different grades to the Institute, and to the foundry trade itself. But just as an ironfoundry business cannot be conducted without a combination of all classes of worker, in the same way, I suggest, the work of the Institute could not be so successful if it did not touch on all aspects of the problems of the trade and embrace all types of worker. In saying this I am not overlooking the fact that one of the primary objects of the Institute is to promote the intellectual welfare of its members, but in the ultimate, the acid test of knowledge is to improve material and mental well-being, and how can this be done if the makers of castings have no trained salesmen to sell their castings, and to sell them at prices which show a return to all in the trade?

The Question of Foundry Supplies

Where would the foundry be without pig-iron and the coke to melt it, the plant to melt it in, and all the different machines which help to make castings better and cheaper? All the people engaged in these allied trades have an interest in foundry work; they want to learn our problems and then study how they can help to solve them.

I am aware of the opinion held by some members that the Institute should not admit to its ranks men of the supplier class, and justify this attitude by pointing to the fact that some members of this type abuse the privileges of the Institute. It has been said that such people have no interest in attending our meetings except for the opportunities they afford of badgering members for orders. That we have such people in our midst I can well believe, and for them I hold no brief. If such cases become common, and are reported to the Council, I believe that a way will be found to curb the activities of these gentlemen who do not observe common decencies. But I believe that such cases are of rare occurrence, and that the great body of supplier members brings valuable support to the Institute. This support is not confined to financial assistance, although its help in this direction is not negligible, and its withdrawal might seriously hamper the success of some of its work and functions. Just as important is the help of those people who use the Institute to study the needs of the trade, and use that knowledge to design a better machine or item of plant. It could be said with some truth that without the co-operation of the allied trades the foundry could not progress. Of what use, for instance, would it be if foundry experts drew up formulæ and specifications for pig-iron and, say, blacking, if the makers of those articles were unable to supply? In my own case, I am primarily a supplier of pig-iron to the foundry trade, and my interest in this Institute is largely to study the requirements of the trade with a view to meeting its needs. This is also the attitude of many others, and it is in this way that real progress can be made. The supplier has this in common with other members of the Institute. He and they all get their living out of the production of castings, and have an equal stake in the technical and commercial well-being of the trade.

Every institute and technical association of which I have knowledge recognises the fact that allied industries can give valuable support, and welcomes representatives to their deliberations. The Institute of British Foundrymen, if it continues to govern itself on broad lines, will welcome the help and assistance of respectable and responsible representatives of allied trades.

The Technical Committee

I have already referred to the work of the Technical Committees of the Institute, and I think it is worth emphasising that this work has taken up a great deal of the time of the individuals of the various committees, and has been done entirely voluntarily. It should not be overlooked that most of the tests have been carried out on a practical scale in the works of individual members of the committees, and the time occupied and the expense has been borne by those individuals and their respective firms. No other technical society does, or ever has, conducted joint research of such a character on a voluntary basis. This fact, in my opinion, is not sufficiently appreciated, and I am afraid we are rather inclined to accept the results without adequate appreciation of the individual effort. In my opinion, we should pay tribute not only to the enthusiasm of the individuals constituting the committees and the firms who have supported them, but also to the conveners of these committees. In addition to giving up their time in organising the investigation work conducted, a glance at the Branch programmes in different parts of the country will show that they are also giving their time to presenting these reports to the individual Branches, and thus enabling all members of the Institute to become acquainted with the work they have done."

Vote of Thanks

Mr. A. Harley (Past-President), in proposing a vote of thanks to the President for his address, said that any apology for the side of the industry which Mr. Lunt represented being associated with the Institute, was quite unnecessary. Those who supplied materials and equipment formed an important part of the industry, and if the Institute was an educational body, it was extremely important that these gentlemen should be educated. One way in which they could be educated in the requirements of the trade was by becoming members of the Institute. They then had opportunities of conversation with managers and foremen and learnt a great deal about foundry technique. That was all to the good. He (Mr. Harley) had been a member of the Institute for 24 years, during which he had been responsible for buying considerable amounts of material and equipment, and so far as he could recollect never once had any supplier approached him in an improper manner at any meeting either of a Branch, the Council or the Conference.

Mr. F. J. Cook (Past-President), who seconded the motion, said the Institute, in his opinion, should welcome as members both those who supplied and those who used. The membership comprised a number of suppliers who were helpful in many ways.

The vote of thanks was heartily accorded, and the President, speaking in acknowledgment, said he was pleased that his remarks had resulted in the question of supplier members being ventilated.

The Report of the Cast Iron Sub-Committee

Following the presidential address, Mr. P. A. Russell, B.Sc., introduced the report* of the Cast Iron Sub-Committee, which was presented to the recent conference at Manchester. Mr.

* Foundry Trade Journal, Vol. L, page 407 *et seq.*

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Russell, who is the Convener of the Sub-Committee, said they welcomed the opportunity of further discussing the report for two reasons. In the first place, at the Manchester conference the time was very limited, and, secondly, the Sub-Committee could only continue its work by having its views thoroughly ventilated, and by finding out what were the wishes of the Institute. It was useless prolonged experiments being carried out if they were not regarded as necessary by the Institute as a whole. The major part of the report dealt with the effect on cast iron of phosphorus and total carbon. The investigation was undertaken, originally, to repudiate, or otherwise, the suggestion that there was a dangerous range with phosphorus between 0.4 and 0.6 per cent. Possibly a little over-emphasis was placed on this aspect of the inquiry. The investigation broadened out considerably, and in the end the question of the dangerous range was only included as an incidental part. To his mind, a more striking thing that emerged from the report was the effect of total carbon, rather than the effect of phosphorus. He did not claim that the report was in any way cutting new ground, that people did not know beforehand the importance of total carbon, or even of phosphorus. But the Sub-Committee seek to clarify the existing position, and to condense in one Paper the work of many members. One of their difficulties was the definition of porosity. The form of porosity that they were investigating was the form in which it occurred as large internal voids in castings, as distinct from what were loosely called porosities—gas-holes, sinking, and in some cases simply coarseness of the graphite flakes. A second difficulty in starting the work was to find a satisfactory porosity test. A great deal of preliminary work was done in an endeavour to obtain a quantitative-porosity test, but they failed. They had only been able to express it comparatively. The most satisfactory comparative test they found was an improvement of the K test, for the introduction of which Mr. Cook was partly responsible. It was necessary to use a larger test-piece than the normal K piece, because the cast iron under investigation did not show any porosity in the normal section K test.

A number of lantern slides and graphs were shown illustrating various points in the report, and these were briefly discussed by Mr. Russell. In conclusion, he said that while the Sub-Committee had done its work in accordance with the British standard specification for grey iron, which involved the use of round bars, he thought the subject needed ventilating with a view to the ultimate revision of the specification.

DISCUSSION

MR. E. J. LEWIS asked whether any work had been done on the question of machinability. In low-carbon irons was any chilling effect noticed on the skin?

MR. H. G. HALL described the report as particularly sound. He mentioned that some six or seven years ago the metal used by his employers had a refined iron base, but later, owing to a change in the chief metallurgist, a hematite base was adopted. In his (the speaker's) opinion the change was not for the better, porosity being increased. He was therefore particularly pleased to hear the qualifying statement that the conclusions to be drawn from the report should not be taken too literally, because it seemed to him that the effect of lowering total carbon to reduce porosity might easily be upset if the lower total carbon was obtained by the use of hematite and steel scrap.

MR. E. W. WYNN, discussing the points raised by Mr. Lewis, said that if they reduced the carbon and phosphorus mainly by the addition of steel it was usual to have a higher sulphur content. If the sulphur was not carefully controlled they would get chilled edges. With a lower phosphorus content they must, if they intended to run the same castings, use a hotter metal. Therefore, if they used the same sand, which had a certain refractoriness, the skin would necessarily be harder, due to the increased casting temperature. As regarded the conclusions arrived at by the Sub-Committee, taking into account the methods pursued in the investigation, he thought they were sound. In order to reach the conclusions it was necessary to use the same base irons and the same materials. If the investigation could proceed further, varying the materials, he thought interesting results might be obtained, always bearing in mind, of course, the economic price of the materials used. Quite a lot of emphasis had been laid on casting temperature, but he had not heard any mention of melting temperature. This, however, in his experience, was an important point if they were to produce castings free from porosity.

MR. W. J. MOLINEUX, referring to comments of the Sub-Committee under the heading of Brinell hardness, said he was reminded of tests he carried out some years ago in making synthetic cast iron. Using steel as a base, totally different physical properties were secured with different carburising materials, although within narrow limits the results were similar as to analysis.

MR. F. J. COOK (Past-President) referred to the absence of microphotographs, remarking that it would have been interesting to find in what way the phosphorus was diffused in the different classes of castings. With regard to the K test, it was not recommended for the particular class of work undertaken by the Sub-Committee. The K tests were done with a low-silicon iron. The test did not work well with higher silicon irons, and he congratulated the Sub-Committee upon having arrived at a section which was very useful for the particular line of work that was being investigated.

MR. J. J. SHEEHAN said the question of porosity was of great interest to every foundryman, and particularly to those engaged in the automobile industry. He suggested that there was porosity caused by high silicon, as well as by high phosphorus and high total carbon. Mr. Sheehan showed a lantern slide illustrating what he said was more in the nature of a liquid shrinkage. To get rid of such shrinkage he raised the silicon content, with unfavourable results. By reducing the silicon a point was reached where they got no shrinkage. As to pouring temperatures, with irons above 3.2 total carbon, this was a matter to be taken into consideration. When the total carbon was between 3.2 and 3.4, casting temperature had some effect on porosity, and certainly with percentages of 3.4 or 3.5 the pouring temperature was extremely important.

MR. RUSSELL inquired if the porosity referred to as resulting from pouring temperature was in the nature of internal voids or draws?

MR. SHEEHAN: It was the porosity you illustrated, usually associated with dendrites.

MR. PEARCE, alluding to the cylinder heads illustrated, suggested that the presence of the cores assisted porosity when the phosphorus was high.

MR. T. R. TWIGGER remarked that he valued the report because he felt that, intelligently interpreted at any foundry where there was sufficient technical control to take advantage of it, the report could be of great assistance in producing sound castings.

MR. A. TIPPER asked if some further description could be given of the type of porosity that occurred in both the T-shape bars and the cylinder heads? He would like to hear Mr. Russell's opinion, he said, of the occurrence of the porosity; how it was related to the method of solidification; whether it was liquid shrinkage causing porosity, or in any way connected with solid shrinkage of the castings. Was any other type of casting considered to show this particular defect?

MR. G. W. BROWN thought it might be advisable to carry out some fluidity tests. Such an investigation would probably yield very useful information.

The BRANCH-PRESIDENT expressed surprise that no one had mentioned the section of the report dealing with carbon pig-iron. In his opinion, that was a very important subject. The reticence might be due to the phraseology of the report. It was rather guarded, and hardly seemed to invite discussion. He hoped the Sub-Committee would pursue the matter further.

AUTHOR'S REPLY

MR. RUSSELL, replying to points raised in the discussion, said Mr. Lewis had referred to the machinability of low-carbon irons. Speaking personally, he (Mr. Russell) had found that low-carbon irons chilled very much more readily than did high-carbon irons. In fact, with a 5½ per cent. silicon iron, it was possible to obtain chill in thin sections where the carbon was as low as 2 per cent. In that respect there was an interrelation which needed further investigation. Mr. Hall mentioned porosity increasing with the decrease in phosphorus, due to the use of hematite. He thought the Sub-Committee would agree that probably, by using hematite, worse results would be obtained than with higher phosphorus, but originally better graphitising properties. It was asked, what it was proposed to do on the subject of graphitisation properties. He was afraid that the Sub-Committee, as composed at the moment, had got to sit back and keep its ears open. If it found there was any useful avenue which it could explore, he thought something would be done. He was afraid, however, that a subject which, after all, was enjoying the attention of all the prominent cast-iron metallurgists in the world, was a little bit beyond the scope of the Sub-Committee. If he attempted to answer Mr. Hall's question with regard to the use of steel scrap mixed with high-carbon hematite, he might go on all night. It was a subject that was very much open to dispute, though he thought the bulk of the evidence was in favour of the difficulties of using a semi-steel mixture of the nature indicated for the first time through the cupola. If it went through again, provided the sulphur was controlled, he thought the difficulties could be obviated. Mr. Wynn had asked whether the conclusions had been reached with different materials. Mr. Wynn realised, no doubt, the necessity for keeping the materials constant in any comparable series. But there were confirming series with other materials, and he thought he could guarantee that the results, taken broadly, were correct, particularly on the physical tests. Mr. Wynn had also referred to the question of melting temperature. He could assure Mr. Wynn that in the foundry of Mr. West, where the castings were made, the point was fully appreciated. The point made by Mr. Molineux as to synthetic cast iron with different physical properties and different carburising materials was very interesting, and he would pass it on to the Sub-Committee for inclusion in their thoughts on the subject. Mr. Cook had deplored the absence of photo-micrographs. In reply, he might say that they seriously considered the question of introducing the theoretical aspect of the subject in the form of phosphide eutectic, but after mature consideration decided that their knowledge was not sufficient. He could endorse Mr. Sheehan's remarks on the effect of high silicon on liquid shrinkage. Mr. Sheehan's observations on pouring temperature, however, cut right across what the Sub-Committee had found, and would have to be taken into consideration when the subject was next under review. Mr. Pearce had discussed the effect of cores. There was little doubt that cores did attract porosities to a particular position. Mr. Twigger had emphasised the practical character of the report. It was sometimes asked whether a Technical Committee was necessary, particularly a Cast Iron Committee. The report had been presented by practical men engaged in the industry, and showed that the Technical Committee had a very definite field within the industry. He was very

(*Concluded on page* 264.)

Foundry Supplies and Research Efforts

MR. PEACE'S SUGGESTIONS

At the opening meeting of the East Midlands Branch of the Institute of British Foundrymen, over which Mr. P. A. Russell, the retiring President presided, Mr. A. E. Peace was installed as Branch-President.

Mr. Peace said that his first duty was a very pleasing one. He had to present an Institute Diploma to one of their members, Mr. B. Gale, for a Paper presented to the Wales and Monmouth Branch. It was very pleasing to note the way these diplomas came along to members of the East Midlands Branch.

PRESIDENTIAL ADDRESS

Mr. Peace then gave his address, during which he said:—Mr. Russell and Gentlemen, I take this opportunity of again thanking you for the honour you have conferred upon me in electing me your President, and for the confidence you have shown. The East Midlands Branch has a tradition for good Presidents. You have only to look at the list of Past-Presidents to realise that you have been served by men of high standing in our industry. Our branch, though by no means the largest in the Institute, has been most active, and achieved considerable importance, and this in spite of the large area we cover, and our consequently scattered membership. The success we attained is largely due to our very energetic secretary and to our enthusiastic Council members. With the realisation of this, I shall use every endeavour to uphold the traditional excellence of the East Midlands Branch. What I need, to be a proper and traditional East Midlands President, is the active help of all of you as well as your goodwill. I hope to find time to speak to you later of the help and support which you can give me.

Presidential addresses as a rule deal broadly with some subject and frequently constitute a survey of foundry practice and metallurgy. I do not propose to follow these lines, although I have a great appreciation of the value of history ever since I first heard about 1066.

Foundry Supplies

I have been perturbed for some time by the ease with which foundry suppliers have influenced foundrymen in their selection of materials. I refer particularly to such supplies as blackings, graphites, parting powders, sands, core oils and binders, and ganisters and patching materials. I wish to make it clear that I am not making an attack on the suppliers. They have unquestionably been of great service to foundrymen in introducing new and better materials. What, however, does disturb me about this matter is the present-day foundryman's lack of knowledge of the materials I have mentioned. In many cases we have only the haziest idea of what the supplier is selling us and of what we are using. For this we are largely to blame. Certainly the times have not been conducive to the ready acquisition of learning. Business has been so difficult and competition so keen that we have all been working at high pressure and have not had the energy to devote to the intensive study of what many perhaps may feel to be only minor details of our business.

On the other hand, I do not think the foundry suppliers have done all they might. They have been admitted to the Institute for our mutual advantage and many of them have been excellent members in assisting the affairs of the Institute, but I do feel that they have not given to the Institute, in the way they should, the benefit of their specialised knowledge of the materials we use. There have been some notable exceptions, and perhaps we foundrymen have not profited as fully as we should from the Papers read upon the materials we use. However, I still maintain that the men who are knowledgable, the men who have the experience of the materials I have indicated, have not come forward as they might have done. We ourselves are blameworthy in that we have not sought the knowledge. Just reflect upon what we know about the materials I have mentioned. Is it not obvious that we should be rightly appalled at our ignorance? We are having to learn by bitter experience, and whilst experience is a very good teacher, our education takes a long time and is very expensive to us.

I appeal to you all to increase your knowledge of the lesser-known materials we use, and by your contributions to the discussions at our meetings to show your desire for authoritative help in the way of lectures by those of our members who have the knowledge.

Costing

It is hardly necessary to emphasise the importance of a satisfactory costing system, and yet it is apparent from the widely diverse selling prices of castings which come to one's notice that many foundries either have no costing system or the costing system they have is unsatisfactory. There seem to be many foundrymen who are content to allow things to go on as they did of old so long as their balance sheet shows a profit. They are quite happy if what they lose on the swings is more than repaid by the roundabouts. Such an attitude cannot but eventually bring disaster. There is nothing surer than that the customer now patronising someone's roundabouts will eventually find someone else's swings which will give him all he requires.

The principals of costing are simple, but the execution of the detail is exceedingly difficult. The combination of accountancy and knowledge of foundry work and foundry organisation is by no means common.

The Technical Committee of your Institute has set up a sub-committee to investigate foundry costing, and this committee has worked for some time on the subject. It has dealt exhaustively with the costing of metal at the cupola spout, and the results of the investigation and the committee's recommendations are embodied in a Paper which is being presented this session before many of our branches. Our own branch will receive this Paper on December 8 at Loughborough, when it will be presented by Mr. Bigg, who is a member of the Costing Sub-Committee. The Paper will very shortly appear in print in The Foundry Trade Journal, and I wish you all to study it very carefully. It is very desirable that the sub-committee should receive our criticisms and comments on the recommendations made. I hope that you will give all the attention you can to the Paper, and there will be ample time for you to prepare contributions to the discussion and to consider your own practice and methods, bringing to the meeting your own data to illustrate your points. Please look out for this Paper in The Foundry Trade Journal.

Tolerances on the Dimensions of Castings

At present we make a casting as accurately as we can to the drawing or pattern supplied, but the customer does not always think we have done our best. It has always seemed a curious anomaly to me that a machine shop receives a drawing of a casting in which the machined dimensions show permissible tolerances either plus, or minus, or both. These limits are always within the capacity of tool equipment, and are such as produce an article which will adequately fulfil its purpose. On the other hand, the foundry receives a drawing for a blank casting and tolerances are not mentioned. If a specification is quoted, any reference to dimensions states some such indefinite and untranslatable phrase as "the casting shall conform with the drawing" or "shall be accurate to the pattern." Sometimes the word "reasonably" is inserted, but whether the foundryman's idea of "reasonableness" or the buyer's is the one to be taken is not specified. I think you must all have met with difficulties at some time or another due to the absence of any agreement between the producer and the customer. The Technical Committee has taken up this matter, and a Paper is being prepared on the subject which, it is hoped, will give some guidance to engineers as to what is truly reasonable, and it may be that some pressure may be brought to bear on appropriate bodies to include in specifications for castings some indication of tolerances which the foundryman must be allowed.

I hope that you will think about this matter and give the results of your experience as and when an opportunity occurs. I suggest to you that the subject is vitally important and that we, as foundrymen, are gradually being forced by the engineers and their inspectors to take over responsibilities regarding dimensions which are more appropriate to the machine shops. I feel that this question is one upon which we have to wage battle and I trust that you will all arm yourselves with data from your experience in order to defend yourselves when the necessity arises in your own individual cases.

I now wish to address you more personally. You will remember that earlier in my remarks I referred to your help and support during my presidential year. I want to tell you how I think you can best achieve this help, which I am confident you are only too anxious to give. The value of our Institute to each of you individually is to be measured not by what you can get out of it, but rather by what you put into it. Let me illustrate what I mean by that. You come to the meetings and you listen to the Papers read and to the discussions—you probably go away saying "so and so was a good idea, I'll use it." If you are doing that and no more, you are missing the best our Institute has to offer you. There are so many of you who never contribute to the discussions, and yet I am assured from my own experience and from observation of others that herein lies the greatest benefit to you, both individually and collectively. Your reluctance to join in the discussion is, I know, due to nervousness and lack of coffidence in speaking, but do you not realise that you would be talking upon a subject which is your daily bread, a subject on which you are each in some way or another worthy of the name of "an authority." I am positive that many who during the winter talk so confidently about the technique of football know much less about that game than you do about your daily job. I do beg of you to realise that unlike the cockney phrase "It isn't wot 'e sezs, its the narsty wye 'e sezs it," it *is* what you say and not the way you say it that counts.

I can assure you that the East Midlands Branch is most indulgent of members speaking for the first time, and I want you to know that during my year of office I shall do all I can to encourage those who do not usually take part in our discussions. Before you come to the meeting you have an opportunity of thinking about the subject of the Paper to be read. I do not think you realise the value to yourselves individually of considering the subject carefully in the light of difficulties of your own experience, of preparing points to raise and comment upon, and of bringing forward results from your own practice. Now, during this session please do not be shy of getting on your feet and saying those things which, in the past, you have saved until after the meeting. It is in this way that you can best assist me to carry out my duties and to make this session one of the greatest value to us all individually, to the East Midlands Branch, and to the Institute of British Foundrymen.

XUM

MR. P. A. RUSSELL said that whilst it was not usual to discuss a presidential address, Mr. Peace would welcome any comments the meeting had to raise.

Vote of Thanks

MR. T. GOODWIN (Past-President), proposing a vote of thanks, said he must first congratulate Mr. Peace for the able manner in which his address had been delivered.

MR. BUNTING had great pleasure to second the vote of thanks. The President, he said, had touched upon subjects that were seldom brought out by a President. Mr. Russell had said the President's address would be open for discussion.

MR. PEACE thanked both speakers for their kind remarks. On the question of tolerances, inspection by engineering firms had become more severe, but the inspectors seemed to be devoid of foundry training.

MR. P. A. RUSSELL said he knew Mr. Peace had this question of tolerances at heart. Mr. Peace was quite modest when he said the Technical Committee were preparing a Paper. As a matter of fact, Mr. Peace was preparing the Paper, at the request of the Technical Committee. He (Mr. Russell) did sympathise with Mr. Peace on specifications for foundry materials. What Mr. Peace wanted was to bring buying of materials to a scientific basis. Pig-irons were now bought to specification, but such things as ganisters, etc., were not on that basis, and he was sure the time was coming when it would be necessary.

MR. HALLAMORE would like to draw a little more information from Mr. Peace. He had been using a supply of coal dust that was quite satisfactory, but had been quoted prices much lower. He would like to know what simple tests could be made in a small foundry for testing a sample of this material.

MR. BUNTING said that on the question of tolerances, he thought they were bound a little with prejudice. They tried to remain in the old groove. The old saying was "Give them some metal," but now they were tied to a certain measurement and they "don't like it." It was necessary to put their own house in order a little and prove they could work to fine limits. The engineering side had also got to recognise that it was impossible to produce castings to those limits on the old basis. With the improvements they had made and were making with machine-produced castings, the foundryman had to admit he has no case for excess metal. It was up to the engineer to send a pattern that was suitable to make the castings they specified. If the foundry had good material to work from it could produce the castings required. It used to be the thing to have ½-in. machining; now $\frac{1}{16}$ in. was common. Another point is the amount of taper for draft; with the improved methods of moulding they could work with less taper than they could a few years ago.

A MEMBER said that he would agree with the President on the question of costing. A foundry might produce a profit and loss account showing a fine profit, but they might also have some lines showing a loss. Cost accounts were the only way to find out. Foundry costing was one of the most difficult in existence. He thought the secret of success was in the co-operation between foundry foreman, manager, and cost accountant. Requisitions for stores were most essential. The people in the works were generally lax in giving full details of what they required. Unless the cost accountant had full details it was difficult to arrive at definite job costs.

MR. PEACE, in reply, said that coal dust was usually tested by an approximate analysis giving volatile and ash contents, and a screen test, but as to what was the best size of screen was a debatable point and depended on the class of work. The publications on coal dust had been almost confined to the work of Mr. Ben. Hird, who was a foundryman. Suppliers had not given the desired information, and that is where they were lacking. He thought the supplier could give them more information if they would. As to tolerances, he would cite a case where a sample was sent to a new pattern, but was rejected, and after many alterations to pattern, a sample was accepted some six months later, which, when compared by suppliers' examiners with the original sample, was identical in all respects. No one seemed to know what limits were "reasonable or proper."

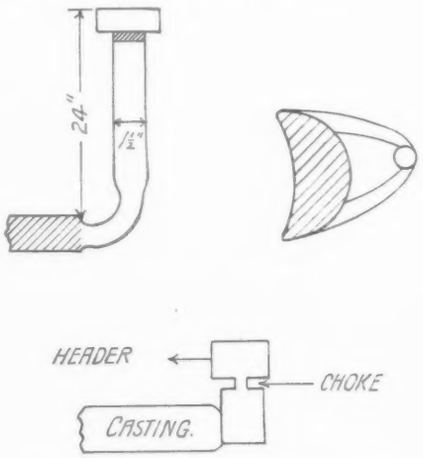
Foundry Queries and Answers

PHOSPHOR-BRONZE GEAR-WHEEL CASTINGS

We are subscribers to THE FOUNDRY TRADE JOURNAL, and will be pleased if you can help us to overcome the following problem:—

We are experiencing a little trouble with phosphor-bronze gear-wheel castings, through castings having a number of blemishes on the face; also, when machining, the same trouble arises. We give below the method we employ for moulding:—

The mould is made from new sand, painted with wet blacking and put in stove to dry. When perfectly dry, it is cast and a choke runner is used, a sketch of which we show below.



THE LOWER DIAGRAM INDICATES THE PRESENT METHOD OF RUNNING, AND THE UPPER THE SYSTEM SUGGESTED.

We take every care when carrying out the above operations, and cannot understand why we get castings as we state.

Your advice on the above, if any, would be greatly appreciated by

C. E. W.

We consider the trouble experienced with these castings is due to the casting temperature and method of running. That is, of course, providing the mould is perfectly dry. The most suitable casting temperature would be about 1,100 deg. C., and if the furnaces used for melting are of the reverberatory type, the metal should be melted under slightly oxidising conditions. It is suggested that the method of running be altered, not using a riser on the casting. The runner should be 18 in. to 24 in. high and 1 in. to 2 in. in dia., and sprayed to enter the casting. Also, a dozzle be used in the runner box, which will act as a scum gate or strainer. The dozzle is a dry-sand perforated cake which sits between the runner box and runner.

It is only on the large size of casting where a riser of any description is used. Much better results are obtained by getting a good head of metal and consequent pressure in the mould. Care must be taken to weight the boxes sufficiently. It is probable that small runners and risers are a source of trouble in the brass foundry.

J. W. G

UNMACHINABLE IMPELLER CASTINGS

We have received several answers to "PUMP'S" inquiry on page 240 of last week's FOUNDRY TRADE JOURNAL. The casting is 5 in. in diameter over all.

"Practical" writes:—The writer would like to know if the sketch given is full size or just a drawing to show shape of casting. If we assume it to be full size, a good plan would be thoroughly to dry the mould, and then cast with a mould temperature of 300 deg. C. with a silicon content of 1.5 to 2.0 per cent. and metal very hot. With small runner gate on the boss and whistlers or scratch-off risers on the joint of the mould, to allow any gas, air or steam to escape, we see no reason why the above should not be successful, and would be pleased to hear the result of the trial.

"J. A. S." also suggests a hot mould (200 to 300 deg. C.), and also the use of an internal spiral in the boss.

"W. R." suggests annealing by placing in a ladle full of hot coke overnight.

"L. G." thinks that the job should be made as an oil-sand core, using black sand instead of sea sand. He further suggests that, if there be many to make, the mould should be stacked six or eight high, running from the tips and rising through the central boss.

"C. D. A." suggests that the following analysis would be a more suitable specification, *viz.*:—T.C., 3.80; Si, 2.80 min.; Mn, 0.80; P, 0.45 max.; S, 0.100 max., per cent. The casting should be made in green sand under these conditions; using the ring riser is a help, but it is not essential, as it does not necessarily retard the cooling.

The Institute of Vitreous Enamellers

London Section.—An informal meeting was held last Friday at British Industries House, Marble Arch, under the chairmanship of Mr. B. B. Kent. The following were elected to the local committee:—Mr. B. B. Kent (chairman), Mr. J. H. Coupe (hon. secretary), Mr. V. C. Faulkner (Editor, FOUNDRY TRADE JOURNAL), Mr. J. H. Gray, Mr. H. Savage, and Mr. W. E. McCalla, and Miss E. C. Elliot (*ex-officio*).

Two more lectures were added to the programme, one by Mr. Kenneth Hill on "Sand Blasting," and a second by Mr. J. H. Gray on "The Lay-out of a Vitreous Enamelling Shop." When the question of works visits was brought up for discussion, no less than seven industrial establishments kindly offered to open their doors. These included three enamelling works, a "pistol" factory, a frit works and a research laboratory. The second meeting was held last night, when Mr. Oakley-Evans, of Armco, Limited, read a Paper on enamelling irons.

Allied Traders and the Institute

(*Concluded from page* 262.)

glad that Mr. Tipper had raised the question of the type of porosity. It was what he (Mr. Russell) called inter-dendritic porosity. It was not a solid shrinkage. It might have been a solidification shrinkage, but it took place while the metal was in a semi-liquid state. With regard to Mr. Brown's suggestion that there should be fluidity tests, the matter had engaged the attention of the whole of the Technical Committee, who were dealing with it in all its aspects. He was glad the President had encouraged them to continue with the carbon pick-up experiments.

On the motion of MR. GARDOM, seconded by MR. BROWN, the meeting passed a cordial vote of thanks to Mr. Russell, who briefly acknowledged the compliment.

XUM

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This Week's News in Brief

Trade Talk

THE RAWDON FOUNDRY, LIMITED, Moira, near Burton-on-Trent, have received orders for de-airing brick machines.

THE MOTOR SEINE-NET BOAT "Shannon," built and fitted out at Messrs. Wood & Sons' yard at Lossiemouth, has completed successful trials in the Moray Firth. The vessel is propelled by Gardner semi-Diesel engines.

A CONTRACT for materials for the Kut barrage across the River Tigris in Iraq has been received by an Aberdeen firm, four aerial cableways having been ordered from Messrs. John M. Henderson & Company, Limited, King's Works.

MESSRS. WILLIAM HAMILTON & COMPANY, LIMITED, Port Glasgow, have secured an order from the United Africa Company, Limited, London, to build a cargo steamer of about 8,000 tons deadweight. The United Africa Company already have a fleet of seven vessels, four of which were Clyde built.

ORDERS TO THE VALUE OF £20,000 have been booked by Messrs. John Spencer & Sons (1928), Limited, of Newburn-on-Tyne, and employment is being found for 120 men for six months. The work includes the axles for 150 locomotives recently ordered by the L.M.S. and also work for China and certain Indian railways.

A CLAIM FOR PAYMENT of wages on Friday evening to Clydeside workers is to be discussed at a local conference between representatives of the Clyde Shipbuilders' Employers' Association and the trade unions having members employed in Clyde shipyards. In certain of the yards wages are already being paid on Friday instead of Saturday.

MESSRS. AITCHISON BLAIR & COMPANY, LIMITED, Whitecrook engine works, Clydebank, have received an order for the construction of one set of marine steam reciprocating engines. The triple-expansion machinery, together with boilers and auxiliaries, is to be built to a first-class specification for a large steam yacht. This is the eighth set of machinery which the firm have booked this year.

THE FIRM OF Alexander Macpherson & Company, machinery merchants, 2, Open Shore, Greenock, has been dissolved by the death of Mrs. Henrietta King, one of the partners. For the purpose of winding up the firm, Mr. Robert Houston Rowan, C.A., 13, Hamilton Street, Greenock, has been appointed liquidator. Mr. Frederick I. C. Tannahill will continue the business under the same firm name on his own behalf.

MESSRS. BABCOCK & WILCOX, LIMITED, are starting immediately on a large extension of their Dumbuck Works at Dumbarton, plans for which have just been passed by the local Dean of Guild Court. The plans show a large steel-frame building to cover approximately 2,000 sq. ft. There will be three bays—one an extension of the existing foundry, another to be used as patternshop, store and offices, and another for the manufacture of brass fittings.

DURING THE PAST WEEK many steelworkers and their families left the Mossend district and joined in the trek south to Corby to take up employment at the new works of Messrs. Stewarts and Lloyds, Limited. Members of the central research department of Messrs. Stewarts and Lloyds also left for Corby this week. There is now a large colony of Mossend and Bellshill people at Corby, and it is expected that the number will be considerably increased within the next month.

LAST WEEK it was reported that Messrs. Hurst Nelson & Company, Limited, Motherwell, had received an order from the L.M.S. Railway for 500 special wagons, amounting in total value to £500,000. The firm have been inundated with requests for employment, and have been obliged to post a notice at the works gate intimating that the report was untrue. Apart from the truth or otherwise of the report, it should be noted that the cost of a railway wagon is nearer £150 than £1,000.

THE LIQUIDATOR of the Low Moor Foundry, Limited (in voluntary liquidation), has ordered the premises, property and plant to be re-offered for sale by public auction in Bradford on October 30. On April 26 the Low Moor Foundry and adjoining freehold property was offered for sale by public auction, and the foundry was purchased by Messrs. Ellington's, Limited, of London. It is understood that the buyers did not complete the purchase and it has become necessary to put the property up again.

A PARTY OF MEMBERS of the South Wales Institute of Engineers, accompanied by the President (Mr. J. MacLeod Carey), visited the Aberthaw and Bristol Channel Portland Cement Works on Friday, October 12. Thanks were accorded by Mr. Carey to Sir John Beynon and his directors, at whose invitation the company were entertained to lunch and tea. Sir John, responding, said the asbestos-cement plant had been installed only a short while. His board had required considerable courage to embark upon such a big capital expenditure, but he believed that the confidence they had in the new venture would benefit the district.

MESSRS. COLVILLES, LIMITED, have restored in full salary cuts effected some years ago under stress of poor business. Last week-end staff workers at the various works and head offices received a restoration of 5 per cent. of their salaries, together with fifteen weeks' back payment. Higher-paid men who suffered a 10 per cent. reduction had 5 per cent. restored a few months ago. Tradesmen and plant operatives whose wages depend on certain boards and awards are not affected. The upward adjustment marks the achievement of a satisfactory profit-earning position. The company estimate that they may make a profit of £500,000 during the current year.

IN THE COURSE of his presidential address to the members of the West of Scotland Iron and Steel Institute, this week, Dr. Andrew McCance referred to the efforts now being made to resuscitate the pig-iron and steel industries of the West of Scotland. He stated that, so far as pig-iron was concerned, the position of Scotland had changed very much for the worse. Instead of holding a dominating position in the pig-iron markets of the world, she had ceased to be a factor of any great importance. Dr. McCance described the technical advances which had taken place in the construction and operation of blast furnaces in recent years, and suggested that similar methods should be adopted at Scottish furnaces.

THE LEVENBANK FOUNDRY of Messrs. Hardie & Gordon, Limited, at Dumbarton, was for many years famed for the large tonnage of heavy marine castings of exceptional quality which it produced, but in common with most other foundries it has suffered from the effects of the post-war depression. The directors recently appointed Mr. George Longden, of Messrs. Craven Bros., as foundry manager. They have now decided to rebuild and modernise the foundries, in an effort to restore the pre-war prosperity. The yard is to be entirely rearranged and covered with roofing to prevent delay and inconvenience due to weather conditions, and to permit of a more efficient handling of material. Machines are being installed in the moulding shops, and a sand-preparation plant will be provided to supply sand mixtures suited to the work in hand. Obsolete plant is to be replaced with that of the latest type, and everything possible is to be done to bring the establishment thoroughly up to date.

Contracts Open

Argentine, November 9.—2,500 iron, steel and brass valves, cocks, etc., for the Argentine State Oilfields Directorate. The Department of Overseas Trade. (Reference G.Y. 14,396.)

South Africa, December 10.—Two 15-ton electrically-driven portal jib cranes, for the South African Railways and Harbours Administration. The Department of Overseas Trade. (Reference A.Y. 12,697.)

Dewsbury, November 10.—Concrete-lined cast-iron pipes, 816 yds. 30 in. dia. vertically cast, 5,989 yds. 20 in. dia. centrifugally cast, for the Dewsbury and Heckmondwike Waterworks Board. The Engineer to the Board, Tithe Barn Street, Dewsbury.

Company Reports

Lennox Foundry Company, Limited.—Net loss of £2,152, increasing the debit brought in to £20,323.

Motherwell Iron & Steel Company, Limited.—Loss on manufacturing account, £639; ordinary overhead expenses, less sundry income, £3,234; bond, overdraft and debenture interests, £8,106; debit balance, £11,979; debit brought in, £85,456; total debit, £97,436.

Personal

MR. GEORGE BUCHANAN, M.P., has been re-elected President of the United Patternmakers' Association.

MR. H. CECIL VICKERS has joined the board of the Hydraulic Coupling & Engineering Company, Limited.

MR. ROY STUBBS attended the annual dinner, on Friday, of the Institution of Mechanical Engineers in his official capacity as President of the Institute of British Foundrymen.

MR. H. C. CARVER, who is a member of The Institute of Vitreous Enamellers, and until recently had been works manager to the Vitreous Enamels, Limited, of Tyseley, Birmingham, has been appointed to the board of directors of this company.

FLIGHT-LIEUT. GEOFFREY SHAW, M.A., flying the Klemm Eagle in the Mildenhall to Melbourne race, is a member of the Middlesbrough Branch of the Institute of British Foundrymen, and son of the late William Shaw, Branch President at the time of the Conference in 1930.

MR. J. W. TANGYE, assistant managing director of Messrs. Tangyes, Limited, engineers, Cornwall Works, Birmingham, has left England for a business tour of the world. He is first proceeding across Europe to the Near and Far East, and after calling at New Zealand, will travel to South America. It is expected Mr. Tangye will be away for a period of about fifteen months.

Obituary

MR. E. J. WILEY, a director and works manager of James Wiley & Sons, Limited, Eagle Works, Darlaston, and Normalized Bolts, Limited, died recently.

New Companies

(From the Register compiled by Jordan & Sons, Limited, Company Registration Agents, 116 to 118, Chancery Lane, London, W.C.2.)

Hartcliffe Lee & Malkin, Limited, 75, St. Simon Street, Salford, Lancs.—Capital £4,000. Brassfounders and chainmakers. Director: W. Harney.

Thomas Dryden & Sons, Limited, Grimshaw Street Ironfoundry, Preston.—Capital £40,000. Engineers and ironfounders. Directors: W. Dryden, J. B. Dryden, N. Dryden and W. Dryden.

Forthcoming Events

NOVEMBER 8.

Institute of Metals:—"Recent Trends and Future Developments in Metallurgical Research," Paper by H. Moore, C.B.E., D.Sc., Ph.D., at the Royal School of Mines, South Kensington, London, S.W.8, at 8 p.m.

Institute of British Foundrymen

OCTOBER 26.

Middlesbrough Branch:—"Some Recent Developments in Foundry Melting Practice," Paper by H. Cowan, B.Sc., at the Cleveland Scientific and Technical Institute, Corporation Road, Middlesbrough, at 7.45 p.m.

OCTOBER 27.

East Midlands Branch:—"Cupola Practice," Paper by L. W. Bolton, A.M.I.Mech.E., at the College of Technology, Leicester, at 6 p.m.

Newcastle-upon-Tyne District Branch:—"Grey-Iron Castings for Laundry Machinery," Paper by J. Longden, at the Neville Hall, Westgate Road, Newcastle-upon-Tyne, at 6.15 p.m.

Scottish Branch:—"Some Thoughts on Indian Foundry Production," Paper by W. T. Bruce, at the Heriot-Watt College, Chambers Street, Edinburgh, at 4 p.m.

Wales and Monmouth Branch:—"Oven-Drying of Cores and Moulds," Paper by E. G. Fiegehen, introduced by J. J. McClelland, at the University College, Newport Road, Cardiff, at 6.30 p.m.

NOVEMBER 2.

Birmingham, Coventry and West Midlands Branch:—(1) Visit to Alfred Herbert, Limited, Coventry; (2) "Some Possibilities in Foundry-Sand Practice," Paper by J. J. Sheehan, A.R.C.Sc.I., A.I.C., at the King's Head Hotel, Coventry, at 7.30 p.m.

NOVEMBER 3.

Lancashire and West Riding of Yorkshire Branches:—Joint meeting. (1) Visit to the Lancashire Foundry Coke Company's plant, Altham, Accrington; (2) "Description of the Processes at the Altham Coke Plant," Paper by Mr. Hollingsworth, at the Engineers' Club, Albert Square, Manchester, at 4 p.m.

The Institute of Vitreous Enamellers

OCTOBER 26.

Northern Section:—"Enamelling Iron," Paper by N. H. Oakley-Evans of Armco, Limited, at the Queen's Hotel, Manchester, at 7.30 p.m.

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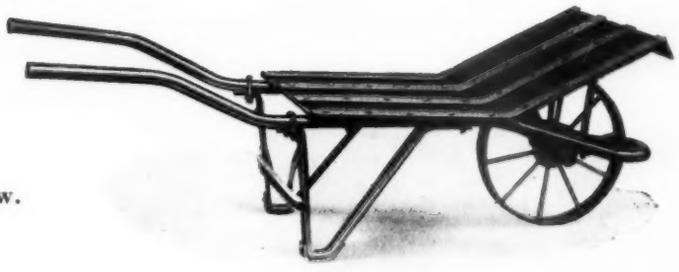

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Raw Material Markets

Conditions in the home iron and steel trade have shown little alteration during the past week. The volume of new business is comparatively small, but bears little relation to the heavy tonnages of material which are actually being delivered. No increase has yet taken place in the production of pig-iron, but makers' stocks are being steadily reduced.

Pig-Iron

MIDDLESBROUGH.—New orders for Cleveland iron have been scarce, but this does not greatly concern the ironmasters, as they have well-filled order-books extending beyond the year-end. Export business is limited, but the current home demand is very heavy, particularly from the light-castings makers. Sellers are reluctant to disclose the prices accepted for overseas sales of pig-iron, but it is understood that 60s. per ton f.o.b. has been accepted for No. 3 Cleveland G.M.B., whereas the minimum home prices are:—67s. 6d. per ton delivered Middlesbrough, 69s. 6d. delivered North-East Coast, 67s. 3d. delivered Falkirk, and 70s. 3d. delivered Glasgow. The premium for No. 1 foundry grade remains at 2s. 6d. per ton, and 1s. per ton discount is allowed on No. 4 foundry and No. 4 forge.

There is a substantial home demand for East Coast hematite, sufficient to absorb the increased production in spite of the poor support from the export markets. For the home market hematite makers have been able to maintain the recent advances in the minimum rates, and the fixed delivered quotations for No. 1 East Coast quality are as follow:—Delivered Middlesbrough, 69s. per ton; delivered North-East Coast, 71s.; delivered Yorkshire, 75s. to 78s.; delivered Scotland, 75s.; delivered Lancashire, 76s.; delivered Birmingham, 79s.; and delivered London (by rail), 83s. 6d. per ton.

LANCASHIRE.—Deliveries of pig-iron to Lancashire consumers are making a satisfactory showing this month. Improved conditions are to be noted at a number of textile-machinery and machine-tool establishments. For delivery in the Lancashire zone, Staffordshire and Derbyshire brands of No. 3 are on the basis of 74s. per ton, with Northamptonshire at 72s. 6d., Scottish foundry at about 82s. 6d., West Coast hematite at 78s. 6d., and East Coast at 75s. to 76s.

MIDLANDS.—New business in pig-iron is rather meagre, the larger consumers being covered ahead for three or six months. The current demand is approximately equal to the output, stocks remaining unchanged. There have been no changes in prices, the minimum controlled rates, delivered to Birmingham and Black Country stations, being 67s. 6d. for Northants No. 3 and 71s. for Derbyshire, Lincolnshire and North Staffordshire No. 3, subject to a small graduated rebate to the large consumers. With regard to better grades of iron used in connection with the general foundry and engineering trades, much competition is to be found between the different makers in various parts of the country. Medium-phosphorus pig is quoted from various sources at between 72s. 6d. and 80s., low-phosphorus iron, including Scottish No. 3, at 85s. to 87s. 6d., and special refined iron for engine and similar work, etc., from £5 10s. up to £6 16s. per ton, delivered Midland points. The hematite market in this district is not very active. Existing rates are £3 18s. for East Coast and £4 4s. 6d. for West Coast hematite, these being controlled levels. Welsh hematite, which is still uncontrolled, is somewhat cheaper than East Coast iron.

SCOTLAND.—As the bulk of the iron being made is delivered against old contracts, any business coming on to the market is of a hand-to-mouth character. There is no alteration in prices, the official minimum of 70s. for No. 3 foundry f.o.t. furnaces still being quoted, with 2s. 6d. extra for No. 1. The light-castings makers continue to be well employed and are taking good deliveries of English iron. There is no change in the quotations for Cleveland, which remain at 67s. 3d. f.o.t. Falkirk and 70s. 3d. f.o.t. Glasgow for No. 3 foundry, No. 4 foundry being 1s. less.

Coke

The makers of foundry coke are very heavily booked over the winter months. Prices are firm, and there is a distinct possibility of an early increase. Quotations for delivery in the South Staffordshire area are as follow:—Best Durham coke, 36s. to 40s.; other grades, 34s. to 35s.; Welsh coke, 35s. to 45s., according to analysis; Scottish low-ash coke, about 40s. per ton.

Steel

There are already signs that the lull in the demand which has been noticeable in the steel market is passing and business in most branches is again becoming active. The British producers of semis are in a satisfactory position, as they have considerable orders in hand and lately there has been an influx of new business. In a number of cases consumers are well stocked, and for the moment are not showing much interest in the market. In the finished-steel department, conditions are satisfactory on the whole, although there is a certain amount of irregularity in working. Most of the steelworks, however, have a good reserve of orders on their books, which will keep them well employed until the end of the year. Some of the lighter branches of the industry which have been busily engaged for a long period are now experiencing a slight slackening in the demand, which it is thought will be of a temporary character.

Scrap

There is a steady demand for scrap iron in this country. In the Cleveland district, heavy metal and machinery metal are quoted at 52s. 6d. and 55s. per ton, delivered, with light metal at about 41s. per ton. In the Midlands area, prices remain stable at 55s. for heavy machinery metal in handy sizes, 50s. for good heavy scrap and 47s. 6d. for clean light metal, all delivered works. In South Wales, heavy cast-iron scrap and light metal are both inclined to be firmer at 48s. 6d. and 42s. 6d. per ton respectively, but there is only a restricted demand for good cast-iron machinery scrap at 52s. 6d. to 55s. In Scotland, there have been a few sales of good, clean, machinery cast-iron scrap at about 55s., ordinary heavy cast iron being quoted at 51s. 6d. per ton.

Metals

Copper.—There is a steady demand for copper from users in this country, but consumption at most of the Continental works is still very restricted.

Copper prices on the London market have firmed up noticeably since the beginning of the week. This development followed rumours from America that the United States producers are about to put into effect a general reduction of outputs. The Kennecott Copper Corporation has announced its intention to curtail production to 80 per cent. of the rate permitted under the "code." The U.S. mines have already been withholding supplies from their domestic market for some time.

Daily market prices:—

Cash.—Thursday, £26 1s. 3d. to £26 2s. 6d.; Friday, £26 11s. 3d. to £26 12s. 6d.; Monday, £27 2s. 6d. to £27 3s. 9d.; Tuesday, £27 5s. to £27 6s. 3d.; Wednesday, £27 17s. 6d. to £28.

Three Months.—Thursday, £26 7s. 6d. to £26 8s. 9d.; Friday, £26 17s. 6d. to £26 18s. 9d.; Monday, £27 8s. 9d. to £27 10s.; Tuesday, £27 11s. 3d. to £27 12s. 6d.; Wednesday, £28 2s. 6d. to £28 5s.

Tin.—There was a meeting of the International Tin Committee in Brussels on Monday. Nothing of any great importance transpired, but it was decided to introduce delegates from the consuming countries into the Committee, which virtually controls the industry. Great Britain and the United States were chosen to be represented in a consultative capacity.

There has only been a limited demand for tin on the London market, and the general tone has been somewhat uncertain. Prices rose towards the end of last week, but have since relapsed again. Consumption in this country is, however, well maintained, especially as regards the tinplate works.

Price fluctuations:—

Cash.—Thursday, £230 12s. 6d. to £230 15s.; Friday, £230 17s. 6d. to £231; Monday, £230 17s. 6d. to £231; Tuesday, £230 12s. 6d. to £230 15s.; Wednesday, £230 7s. 6d. to £230 10s.

Three Months.—Thursday, £229 2s. 6d. to £229 7s. 6d.; Friday, £229 5s. to £229 7s. 6d.; Monday, £229 to £229 5s.; Tuesday, £228 15s. to £229; Wednesday, £228 12s. 6d. to £228 17s. 6d.

Spelter.—The first disappointment at the poor Cartel figures for September having abated, the spelter market developed a rather firmer tone this week.

It is reported that the first electrolytic zinc produced by the new German refinery at Magdeburg is now being sold in that country.

Day-to-day quotations:—

Ordinary.—Thursday, £12; Friday, £12 3s. 9d.; Monday, £12 3s. 9d.; Tuesday, £12 8s. 9d.; Wednesday, £12 15s.

Lead.—"The London market has again failed to reflect the position in the home trade, but this is not altogether surprising. Cablemakers in this country have booked better orders, and are now in a very competitive position to take advantage of the increase in electrical development, particularly within the Empire. On the other hand, the American silver-purchasing programme has caused the silver price to advance to an extent which is bound to stimulate mine output, and this may have more serious consequences than can be foreseen at present," report Messrs. Brandeis, Goldschmidt.

Price fluctuations have been as follow:—

Soft Foreign (Prompt).—Thursday, £10 2s. 6d.; Friday, £10 2s. 6d.; Monday, £10 5s.; Tuesday, £10 8s. 9d.; Wednesday, £10 12s. 6d.

Notes From the Branches

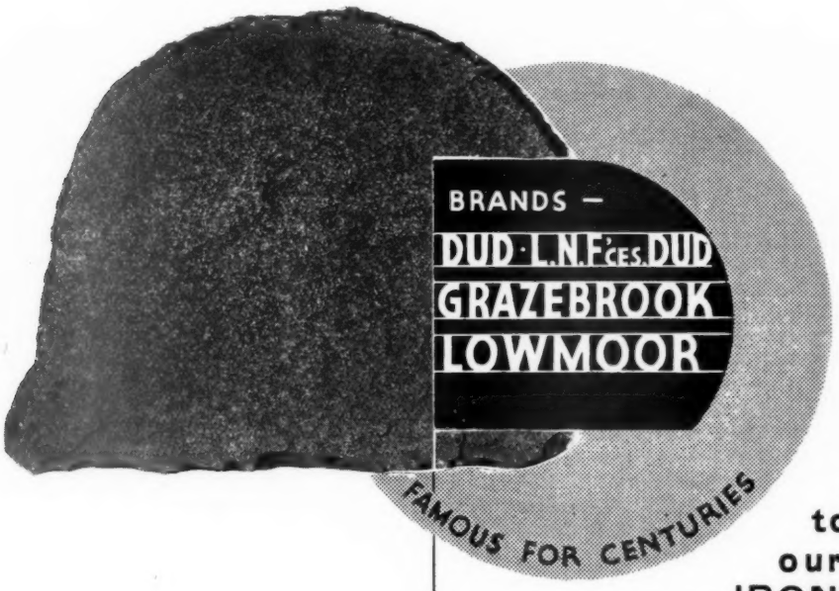
The Wales, Monmouthshire and West of England Branch of the Institute of British Foundrymen opened its session recently with a whist drive at the Park Hotel, Cardiff. During the evening a presentation was made to the hon. secretary, Mr. J. J. McClelland. It will be remembered that an award was made by the Institute at its Annual Convention at Manchester in June, but the medallion was not handed over. This was left for the first meeting of the season. The Immediate Past-President of the Institute, MR. C. E. WILLIAMS, in making the presentation, said that he was not only honoured but delighted to be asked to present this medal to their friend, Mr. McClelland. The medal was a slight token—just a mark of their appreciation of the many years of hard work Mr. McClelland had put in for them as honorary secretary of the Wales and West of England Branch of the Institute of British Foundrymen. The medal is the gift of the Institute and was a token of the appreciation of the whole Institute. It was given for long, meritorious service, and he was glad that such a duty should devolve upon him on the first occasion on which he wore the badge of a Past-President. He could say much of the wonderful way Mr. McClelland had supported him during his year of office as President of the Institute, and he should also include Mrs. Rawden and Mrs. McClelland. If he started to talk about the wonderfully happy Cardiff Conference he should never stop. He would only say that no one in the foundry world could be more worthy to receive this medal than their honorary secretary, Mr. McClelland.

Before the medal was presented hearty cheers were given for Mr. McClelland. These were followed by cheers for both Mrs. McClelland and Mrs. Rawden. In accepting the medal, MR. MCCLELLAND read letters from Mr. Roy Stubbs and Mr. Winterton, both gentlemen apologising for non-attendance at this function.

Mr. McClelland said that he was very appreciative of the goodwill behind this gift, and accepted the thanks to his wife and daughter. It was quite usual for the whole family to join in any work which was waiting to be done, and this had applied to the work of the Branch. Mr. McClelland said he would like to urge all present to do something to improve the Branch. For two years it had practically marked time, and it was necessary for an effort to be made to increase membership. He outlined the advantages to foundrymen and hoped that as a result of this presentation many new members would be enrolled. The master of ceremonies at the whist drive was Mr. C. E. Richards, Branch-President, assisted by Mr. W. Williams, of Cardiff.

XUM

GENUINE COLD BLAST PIG IRON



Our Cold Blast Pig Irons are All-mine Blast Furnace Products.

In addition to their renowned chilling properties, and their resistance to wear and to growth under heat, our COLD BLAST PIG IRONS are noted for their

GREAT STRENGTH *and* TOUGHNESS

If you wish to improve the quality of your difficult engineering castings —to make them sounder, stronger, more durable, try COLD BLAST PIG IRON in your mixture. It is the easiest way. It requires no change in your ordinary foundry practice. The initial cost may be a little more, but it will be a saving to you in the end, if it helps you to turn out higher quality finished castings and to cut down your loss from wasters and rejected castings.

TRY THIS BEST KIND OF ALL BLAST FURNACE IRONS

Write to any of us for particulars.

THE EARL OF DUDLEY'S ROUND OAK WORKS, LTD.,
BRIERLEY HILL, STAFFS.
Brand: "DUD·L.N.F'ces·DUD"

M. & W. GRAZEBROOK,
LIMITED,
DUDLEY, WORCS.
Brand: "GRAZEBROOK"

THE LOW MOOR IRON
CO., LTD.,
NEW WORKS, LOW MOOR,
BRADFORD - YORKSHIRE.
Brand: "LOWMOOR C.B."

MAKERS OF GENUINE COLD BLAST PIG IRON

RAW MATERIALS—PRICE LIST

(Wednesday, October 24, 1934)

COPPER

	£	s.	d.
Standard cash	27	17	6
Three months	28	2	6
Electrolytic	30	5	0
Tough	29	10	0
Best selected	30	0	0
Sheets	56	0	0
India	41	0	0
Wire bars	31	0	0
Ingot bars	31	0	0
H.C. wire rods	33	15	0
Off. av. cash, September	27	11	6¾
Do., 3 mths., September	27	17	6
Do., Sttlmnt., September	27	11	10½
Do., Electro, September	30	15	8½
Do., B.S., September	30	13	1½
Do., wire bars, September	31	0	3
Solid drawn tubes			9¼d.
Brazed tubes			9¼d.
Wire			6d.

BRASS

Solid drawn tubes	8¼d.
Brazed tubes	10¼d.
Rods, drawn	8d.
Rods, extd. or rlld.	4¼d.
Sheets to 10 w.g.	6¼d.
Wire	7d.
Rolled metal	6¾d.
Yellow metal rods	4¼d.
Do. 4 × 4 Squares	5¼d.
Do. 4 × 3 Sheets	5½d.

TIN

	£	s.	d.
Standard cash	230	7	6
Three months	228	12	6
English	230	10	0
Bars	232	7	6
Straits	230	10	0
Australian (nom.)			—
Eastern	230	0	0
Banca	232	2	6
Off. av. cash, September	230	0	0¾
Do., 3 mths., September	227	17	3
Do., Sttlmt., September	230	1	0

SPELTER

	£	s.	d.
Ordinary	12	15	0
Remelted	13	15	0
Hard	10	15	0
Electro 99.9	15	5	0
English	13	17	6
India	12	5	0
Zinc dust	17	0	0
Zinc ashes	3	0	0
Off. aver., September	12	14	10¾
Aver. spot, September	12	12	10½

LEAD

	£	s.	d.
Soft foreign ppt.	10	12	6
Empire (nom.)	11	15	0
English	12	10	0
Off. average, September	10	10	0
Average spot, September	10	7	9

ALUMINIUM

Ingots	£100 to £105
Wire	1/1 to 1/9 lb.
Sheet and foil	1/2 to 2/9 lb.

ZINC SHEETS, &c.

	£	s.	d.
Zinc sheets, English	23	10	0
Do., V.M. ex whse.	22	15	0
Rods	26	15	0

ANTIMONY

	£	s.	d.	£	s.	d.
English	48	0	0	to 50	0	0
Chinese, ex-whse.				43	0	0
Crude					—	

QUICKSILVER

	£	s.	d.	£	s.	d.
Quicksilver	11	2	6	to 11	10	0

FERRO-ALLOYS AND STEEL-MAKING METALS

	£	s.	d.
Ferro-silicon—			
25%	8	17	6
45/50%	13	0	0
75%	18	7	6
Ferro-vanadium—			
35/50%	12/8 lb. Va.		
Ferro-molybdenum—			
70/75% carbon-free	5/6 lb. Mo.		
Ferro-titanium—			
23/25% carbon-free	9d. lb.		
Ferro-phosphorus, 20/25%	£14	10	0
Ferro-tungsten—			
80/85%	3/- lb.		
Tungsten metal powder—			
98/99%	3/3 lb.		
Ferro-chrome—			
2/4% car.	29	15	0
4/6% car.	23	0	0
6/8% car.	21	12	6
8/10% car.	21	12	6
Ferro-chrome—			
Max. 2% car.	36	0	0
Max. 1% car.	38	15	0
Max. 0.70% car.	42	0	0
70% carbon-free	10d. lb.		
Nickel—99.5/100%	£200 to £205		
"F" nickel shot	£184	0	0
Ferro-cobalt, 98/99%	5/3 lb.		
Metallic chromium—			
96/98%	2/5 lb.		
Ferro-manganese (net)—			
76/80% loose	£10 15 0 to £11	5	0
76/80% packed	£11 15 0 to £12	5	0
76/80% export (nom.)	£9	15	0
Metallic manganese—			
94/96% carbon-free	1/2 lb.		

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL

Finished bars, 14% tungsten	2s. 0d.
Finished bars, 18% tungsten	2s. 9d.

Per lb. net, d/d buyers' works.

Extras—	
Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under ½ in. to ¼ in.	3d. lb.
Do., under ¼ in. to ⅛ in.	1/- lb.
Flats, ½ in. × ¼ in. to under 1 in. × ½ in.	3d. lb.
Do., under ½ in. × ¼ in.	1/- lb.
Bevels of approved sizes and sections	6d. lb.

Bars cut to length, 10% extra.

SCRAP

	£	s.	d.	£	s.	d.
South Wales—						
Heavy steel	2	15	0	to 2	18	0
Bundled shrngs.				2	7	6
Mixed iron and steel	2	10	0	to 2	12	6
Heavy cast iron				2	8	6
Good machinery	2	12	6	to 2	15	0
Cleveland—						
Heavy steel				2	10	0
Steel turnings				1	15	0
Cast-iron borings				1	5	0
Heavy forge				2	10	0
W.I. piling scrap				2	5	0
Cast-iron scrap	2	12	6	to 2	15	0
Midlands—						
Light cast-iron scrap				2	7	6
Heavy wrought iron				2	17	6
Steel turnings, f.o.r.				1	13	0
Scotland—						
Heavy steel	2	10	0	to 2	11	3
Ordinary cast iron				2	11	6
Engineers' turnings				1	19	6
Cast-iron borings	1	18	6	to 2	0	0
Wrought-iron piling	2	10	0	to 2	11	3
Heavy machinery				2	15	0

London—Merchants' buying prices, delivered yard.

	£	s.	d.	£	s.	d.
Copper (clean)				24	0	0
Brass				16	10	0
Lead (less usual draft)				9	10	0
Tea lead				7	0	0
Zinc				9	0	0
New aluminium cuttings				66	0	0
Braziery copper				19	0	0
Gunmetal				23	0	0
Hollow pewter				150	0	0
Shaped black pewter				112	0	0

PIG-IRON

N.E. Coast (d/d Tees-side area)—	
Foundry No. 1	70/-
Foundry No. 3	67/6
,, at Falkirk	67/3
,, at Glasgow	70/3
Foundry No. 4	66/6
Forge No. 4	66/6
Hematite No. 1	69/-
Hematite M/Nos.	68/6
N.W. Coast—	
Hem. M/Nos. d/d Glas.	72/6
,, d/d Birm.	84/6
Malleable iron d/d Birm.	115/-
Midlands (d/d Birmingham dist.)—	
Staffs No. 4 forge	67/-
,, No. 3 fdry.	71/-
Northants forge	63/6
,, fdry. No. 3	67/6
,, fdry. No. 1	70/6
Derbyshire forge	67/-
,, fdry. No. 3	71/-
,, fdry. No. 1	74/-
Scotland—	
Foundry No. 1, f.o.t.	72/6
,, No. 3, f.o.t.	70/-
Hem. M/Nos. d d	71/-
Sheffield (d/d district)—	
Derby forge	64/6
,, fdry. No. 3	68/6
Lincs forge	64/6
,, fdry. No. 3	68/6
E.C. hematite	81/6
W.C. hematite	83/6
Lancashire (d/d eq. Man.)—	
Derby fdry. No. 3	74/-
Staffs fdry. No. 3	74/-
Northants fdry. No. 3	72/6
Cleveland fdry. No. 3	74/-
Dalzell, No. 3 (special)	102/6 to 105/-
Glengarnock, No. 3	82/6
Clyde, No. 3	82/6
Monkland, No. 3	82/6
Summerlee, No. 3	82/6
Eglinton, No. 3	82/6
Gartsherrie, No. 3	82/6
Shotts, No. 3	82/6

FINISHED IRON AND STEEL

Usual district deliveries for iron; delivered consumer's station for steel.

Iron—	£	s.	d.	£	s.	d.
Bars (cr.)	9	12	6	to 9	15	0
Nut and bolt iron	7	10	0	to 8	0	0
Hoops	10	10	0	and up.		
Marked bars (Staffs) f.o.t.	12	0	0			
Gas strip	10	10	0	and up.		
Bolts and nuts, ¾ in. × 4 in.	14	0	0			
Steel—						
Plates, ship, etc.	8	15	0	to 8	17	6
Boiler plts.	8	0	0	to 8	10	0
Chequer plts.	10	7	6			
Angles	8	7	6			
Tees	9	7	6			
Joists	8	15	0			
Rounds and squares, 3 in. to 5½ in.	9	7	6			
Rounds under 3 in. to ½ in. (Untested)	8	12	0			
Flats—8 in. wide and over	8	12	6			
,, under 8 in. and over 5 in.	8	17	6			
Rails, heavy	8	5	0	to 8	10	0
Fishplates	12	5	0	to 12	10	0
Hoops (Staffs)	9	7	0			
Black sheets, 24g. (4-t. lots)	10	10	0			
Galv. cor. shts. (,,)	13	0	0			
Galv. flat shts. (,,)	13	10	0			
Galv. fencing wire, 8g. plain	14	10	0			
Billets, soft	5	10	0	and up.		
Billets, hard	6	17	6	to 7	2	6
Sheet bars	5	2	6	to 5	10	0
Tin bars	5	2	6	to 5	7	6

PHOSPHOR BRONZE

	Per lb. basis.
Strip	8⅞d.
Sheet to 10 w.g.	9⅛d.
Wire	11½d.
Rods	9⅛d.
Tubes	12⅜d.
Castings	10½d.

Delivery 3 cwt. free.
10% phos. cop. £30 above B.S.
15% phos. cop. £35 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. CLIFFORD & SON, LIMITED.

NICKEL SILVER, &c.

	Per lb.
Ingots for raising	7d. to 1/1
Rolled—	
To 9 in. wide	1/1 to 1/7
To 12 in. wide	1/1½ to 1/7½
To 15 in. wide	1/1½ to 1/7½
To 18 in. wide	1/2 to 1/8
To 21 in. wide	1/2½ to 1/8½
To 25 in. wide	1/3 to 1/9
Ingots for spoons and forks	7d. to 1/3½
Ingots rolled to spoon size	10d. to 1/6½
Wire round—	
to 10g.	1/4½ to 1/11½

with extras according to gauge.
Special 5ths quality turning rods in straight lengths, 1/3½ upwards.

AMERICAN IRON AND STEEL

At Pittsburgh unless otherwise stated.

	Dols.
No. 2 foundry, Phila.	20.26
No. 2 foundry, Valley	18.50
No. 2 foundry, Birm.	14.50
Basic, Valley	18.00
Bessemer	20.76
Malleable, Valley	18.50
Grey forge, Valley	18.25
Ferro-mang. 80%, seaboard	85.00
O.-h. rails, h'y, at mill	36.37½
Billets	27.00
Sheet bars	28.00
Wire rods	38.00
	Cents.
Iron bars, Chicago	1.80
Steel bars	1.80
Tank plates	1.80
Beams, etc.	1.80
Skelp, grooved steel	1.70
Steel hoops	2.10
Sheets, black, No. 24	2.40
Sheets, galv., No. 24	3.10
Wire nails	2.60
Plain wire	2.30
Barbed wire, galv.	3.00
Tinplates, 100-lb. box	$5.25

COKE (at ovens)

Welsh foundry	25/- to 30/-
,, furnace	19/- to 21/-
Durham foundry	20/- to 25/-
,, furnace	17/6
Midlands, foundry	—
,, furnace	—

TINPLATES

f.o.b. Bristol Channel ports.

I.C. cokes	20×14 per box		18/2
,,	28×20 ,,		36/4
,,	20×10 ,,		26/-
,,	18¾×14 ,,		18/7½ to 18/9
C.W.	20×14 ,,		15/7½
,,	28×20 ,,		33/9 to 34/-
,,	20×10 ,,		23/-
,,	18¾×14 ,,		16/-

SWEDISH CHARCOAL IRON & STEEL

	£	s.	d.	£	s.	d.
Pig-iron	6	0	0	to £7	0	0
Bars-hammered, basis	£16	0	0	to £16	10	0
Bars and nail-rods, rolled, basis	£15	15	0	to £16	0	0
Blooms	£10	0	0	to £12	0	0
Keg steel	£30	0	0	to £31	0	0
Faggot steel	£18	0	0	to £23	0	0
Bars and rods dead soft, st'l	£10	0	0	to £12	0	0

All per English ton, f.o.b. Gothenburg.
[Subject to an exchange basis of Kr. 18.16 to £1.]

DAILY FLUCTUATIONS

Standard Copper (cash)

		£	s.	d.	
Oct. 18 ..	26	1	3	inc.	1/3
,, 19 ..	26	11	3	,,	10/-
,, 22 ..	27	2	6	,,	11/3
,, 23 ..	27	5	0	,,	2/6
,, 24 ..	27	17	6	,,	12/6.

Electrolytic Copper

		£	s.	d.	
Oct. 18 ..	28	10	0	No	change
,, 19 ..	29	0	0	inc.	10/-
,, 22 ..	30	0	0	,,	20/-
,, 23 ..	30	0	0	No	change
,, 24 ..	30	5	0	inc.	5/-

Standard Tin (cash)

		£	s.	d.		
Oct. 18 ..	230	12	6	dec.	7/6
,, 19 ..	230	17	6	inc.	5/-
,, 22 ..	230	17	6	No	change
,, 23 ..	230	12	6	dec.	5/-
,, 24 ..	230	7	6	,,	5/-

Tin (English ingots)

		£	s.	d.		
Oct. 18 ..	230	15	0	dec.	5/-
,, 19 ..	231	0	0	inc.	5/-
,, 22 ..	231	0	0	No	change
,, 23 ..	230	15	0	dec.	5/-
,, 24 ..	230	10	0	,,	5/-

Spelter (ordinary)

		£	s.	d.		
Oct. 18 ..	12	0	0	No	change
,, 19 ..	12	3	9	inc.	3/9
,, 22 ..	12	3	9	No	change
,, 23 ..	12	8	9	inc.	5/-
,, 24 ..	12	15	0	,,	6/3

Spelter (Electro, 99.9 per cent.)

		£	s.	d.		
Oct. 18 ..	14	10	0	dec.	2/6
,, 19 ..	14	15	0	inc.	5/-
,, 22 ..	14	15	0	No	change
,, 23 ..	14	18	9	inc.	3/9
,, 24 ..	15	5	0	,,	6/3

Zinc Sheets (English)

		£	s.	d.		
Oct. 18 ..	23	10	0	No	change
,, 19 ..	23	10	0	,,	,,
,, 22 ..	23	10	0	,,	,,
,, 23 ..	23	10	0	,,	,,
,, 24 ..	23	10	0	,,	,,

Lead (English)

		£	s.	d.		
Oct. 18 ..	12	5	0	No	change
,, 19 ..	12	5	0	,,	,,
,, 22 ..	12	5	0	,,	,,
,, 23 .	12	10	0	inc.	5/-
,, 24 ..	12	10	0	No	change

AVERAGE MONTHLY PRICES OF CLEVELAND No. 3 PIG-IRON.

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly average
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1894	35 8	35 11	36 1	36 1	35 5	35 5	35 5	35 11	36 6	35 8	35 8	35 1	35 9
1895	34 7	34 4	34 4	34 8	35 6	35 2	36 1	37 1	38 10	38 6	37 11	37 6	36 3
1896	37 3	38 4	38 7	38 1	37 4	37 4	36 11	36 11	37 11	39 2	40 5	40 5	38 3
1897	41 2	40 4	40 5	39 2	39 7	40 9	39 6	40 5	41 7	42 5	41 5	40 4	40 7
1898	40 9	40 8	40 6	40 0	40 7	39 11	40 4	41 11	43 0	44 11	49 1	44 3	42 0
1899	46 10	47 11	47 9	49 10	55 11	62 10	71 6	65 9	67 7	68 8	70 0	66 9	60 5
1900	67 10	68 10	73 10	76 2	74 2	68 6	69 3	71 4	70 9	67 8	63 6	53 6	68 9
1901	48 0	46 6	45 8	45 5	45 10	44 7	44 6	45 3	45 3	45 3	43 6	43 1	45 3
1902	43 11	46 7	46 9	47 11	48 10	49 7	50 9	52 1	53 6	52 9	50 9	47 11	49 3
1903	47 3	48 9	51 10	49 0	46 1	46 2	46 7	46 8	45 7	43 6	42 10	41 11	46 4
1904	42 3	42 7	43 3	44 7	44 0	42 10	42 9	43 3	43 1	43 9	46 1	48 7	43 11
1905	48 11	48 0	49 6	50 1	51 5	45 6	45 9	47 5	48 8	52 11	52 9	53 3	49 6
1906	53 9	50 1	48 1	48 8	50 2	50 3	50 6	53 0	54 6	56 8	58 6	62 4	53 6
1907	60 4	58 6	54 10	56 0	61 1	58 1	57 8	57 8	55 7	54 8	50 8	50 0	56 2
1908	48 5	49 3	51 7	51 10	51 6	51 2	50 0	51 4	52 0	49 8	49 4	48 11	50 8
1909	48 10	48 1	46 9	47 9	48 4	48 9	48 6	50 5	51 3	51 11	51 2	50 7	49 4
1910	51 10	51 8½	51 7½	50 10	49 10	49 2	48 10	49 8½	49 3½	49 7½	49 6½	49 10	50 4
1911	49 11½	49 2½	48 5	46 11	46 4	46 6	46 11½	47 4	47 0	46 7	47 4½	48 1	47 7
1912	50 0	49 5½	51 1½	53 7½	54 4	55 1	57 5½	64 6½	61 7½	66 8½	67 8	68 0	58 5½
1913	66 11½	63 8½	64 8	67 1½	66 3	56 9½	56 3½	55 8	55 4	53 0	50 1	50 4	58 10
1914	50 11	51 5½	51 0½	51 4½	51 6	51 6½	51 5	52 3	51 5	50 1	50 3	53 0	51 4½
1915	55 7	56 6	61 0	66 7	65 2	66 10	65 4	66 0½	65 3	65 11	69 10½	75 7½	65 7
1916	80 2	91 6	87 4½	86 10	82 6	82 6	87 6	87 6	87 6	87 6	87 6	87 6	85 10
1917	87 6	87 6	87 6	92 6	92 6	92 6	92 6	92 6	92 6	92 6	92 6	95 0	99 3
1918	95 0	95 0	95 0	95 0	95 0	95 0	95 0	95 0	95 0	95 0	95 0	95 0	95 0
1919	95 0	95 0	95 0	95 0	152 6	160 0	160 0	160 0	160 0	160 0	160 0	160 0	137 8
1920	175 0	175 0	187 6	200 0	208 0	217 6	217 6	221 0	225 0	225 0	225 0	225 0	209 3
1921	222 6	195 0	150 0	126 0	120 0	120 0	120 0	136 3	127 0	120 0	110 0	100 0	137 4
1922	92 6	90 0	90 0	90 0	90 0	90 0	89 0	87 3	92 6	92 6	92 6	91 3½	90 7½
1923	94 6	108 9	125 6	129 4½	128 5	136 0	128 1½	121 11	97 1½	97 0	100 0	100 0	110 6½
1924	99 10	97 3½	91 9	93 9	91 9	89 10½	87 9	85 0	82 5½	80 2½	81 9	81 9	88 7½
1925	80 4½	78 10½	78 0	78 3	76 0	73 10½	71 7½	69 10½	68 1½	66 7½	66 0	66 10½	72 10½
1926	69 4½	70 0	70 0	70 0	72 6	75 10½	86 7½	90 0	93 10½	117 10	120 0	99 0	86 3
1927	85 0	83 1½	81 0	80 0	73 9	70 0	70 0	68 9	67 6	67 6	68 10½	65 0	73 2½
1928	65 0	65 0	65 6	66 0	66 0	66 0	66 0	66 0	66 0	66 0	66 0	66 0	65 9½
1929	66 0	66 9	67 0	68 1½	69 5	71 10½	72 9	72 6	72 6	72 6	72 6	72 6	70 4½
1930	72 6	72 6	70 0	67 6	67 6	67 6	67 6	64 6	63 6	63 6	63 6	63 6	66 11½
1931	59 6	58 6	58 6	58 6	58 6	58 6	58 6	58 6	58 6	58 6	58 6	58 6	58 7
1932	58 6	58 6	58 6	58 6	58 6	58 6	58 6	58 6	58 6	58 6	58 6	58 6	58 6
1933*	62 6	62 6	62 6	62 6	62 6	62 6	62 6	62 6	62 6	62 6	62 6	62 6	62 6
1934*	62 6	65 0	67 6	67 6	67 6	67 6	67 6	67 6	67 6	—	—	—	—

* Delivered Middlesbrough area. Prior to 1933, prices were f.o.t. furnaces.

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WINCHESTER HOUSE, OLD BROAD ST., LONDON, E.C.2.

CLARENCE CHAMBERS, 39, CORPORATION STREET, BIRMINGHAM.
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(A remittance should accompany instructions.)

SITUATIONS VACANT AND WANTED

FOUNDRY Foreman desires position; experienced high-class engineering and jobbing work; iron and non-ferrous; expert on cupola and mixing of metals; knowledge of metallurgy.—Box 922, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

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EMPLOYMENT REGISTER.

Conducted by the Institute of British Foundrymen by courtesy of the proprietors of THE FOUNDRY TRADE JOURNAL.

Correspondence should be addressed to the General Secretary, Institute of British Foundrymen, St. John Street Chambers, Deansgate, Manchester, from whom full particulars can be obtained of this service.

Any employer wishing to communicate with a candidate should write to the General Secretary, quoting identification number.

METALLURGIST, (malleable or grey-iron foundry) requires position. Expert in refining irons to special analysis. Would act as Chief Chemist and take charge of melting, heat-treatments, and assist manager. Executive and research experience. (250)

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AGENCY

AGENCY wanted in Manchester by experienced Engineer for the supply of pig-iron to foundries.—Address, Box 938, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

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FOR SALE.—One Open-Flame Non-Crucible Semi-Rotary Type Melting Furnace complete with No. 2 Keith-Blackman Blowing Fan, 4-in. dia. outlet and motor; cowl, auxiliary oil tank and oil and feed pipes. Motor suitable for 400 volts A.C., 3-phase, 50 cycles. Offers and inspection invited.—CRAVEN BROS. (MANCHESTER), LIMITED, Vauxhall Works, Reddish, Stockport.

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5-ton Western Block, £1 10s.
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Tel.: Hampstead 4903.

NEW Dwarf Cupola, to melt 10 to 15 cwts. per hr. New Worm-geared Ladles, 5 tons, 25 cwts., 15 cwts. and 10 cwts. capacity. Ungeared Ladles, 15 cwts. and 10 cwts. capacity. Improved Cupola Spark Arresters.—T. DAVIES & SON, West Gorton, Manchester.

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Room Plants, sizes 12 ft. x 12 ft., 12 ft. x 9 ft. and 6 ft. x 6 ft., made up in cast-iron sections.

Barrel Plants, 30 in. dia. x 36 in. long and 30 in. dia. x 18 in. long rotary barrels.

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Most of the above by Tilghman and complete with Air Compressors.

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By Adaptable, Fridmore, Darling & Sellars, etc.; Squeezers by Utard (unused), Samuelson and Britannia, also Farwell Universal Type.

Ladles, Grinding Machines, Exhaust Fans, Blowers, Air Compressors and 500 Electric Motors and Dynamos.

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10-ton cap. SLAG LADLES, 6′ 2″ between trunnions.

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Two 10-cwt. TRIPPING LADLES, 2 lips 24″ dia., 20″ deep.

2 Nearly New VERTICAL MULTITUBULAR OIL-FIRED BOILERS, 17′ x 8′ 6″, heating surface 1,000 sq. ft., reinsurable 120 lbs. w.p.

Write for "Albion" Catalogue.

'Grams: "Forward:" 'Phone: 23001 (10 lines).
ALBION WORKS, SHEFFIELD.

MACHINERY—*Continued*

FOUR Osborn Moulding Machines, jolt-press type J.75, practically new, in perfect working order; immediate delivery. Low price.—ALEX. HAMMOND, Foundry Machinery Merchant, Slough.

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RYLAND'S DIRECTORY of the Coal, Iron, Steel, Tinplate, Metal, Engineering, Hardware and Allied Trades. 1934 edition. Price 42s. cloth bound, 52s. morocco. Order *YOUR* copy *NOW*.—INDUSTRIAL NEWSPAPERS, LIMITED, 49, Wellington Street, Strand, London, W.C.2.

'Phone: 287 SLOUGH

MOULDING MACHINES

14″×16″ TABOR split pattern.
18″×18″ TABOR split pattern.
18″×36″ TABOR rollover shockless.
36″×24″ TABOR rollover shockless.
40″×30″ TABOR rollover shockless.

HAND Machines taken in part payment for above or exchanged.

SANDBLAST PLANTS

12′ × 9′ Tilghman sandblast room, built of cast iron plates, complete with 400 cu. ft. Tilghman air compressor and all accessories **£290 Nett.**
T.B. 1 Tilghman sandblast barrel plant, complete.
T.B. 3 Tilghman barrel plant, 2 jet, complete.
60″ "Jackman" rotary sandblast table.
Small Tilghman rotary table sandblast.

BUY FROM ME AND SAVE MONEY!

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PETER—WITH ONE EXCEPTION

With one exception Peter is an ordinary little fellow. Chubby, likeable, just five-and-a-half, full of life and fun and on occasions—be it admitted—of naughtiness.

Just now Peter's rather important, for this is his first term at school, and he's grappling with the intricacies of "A B C" and "Twice-Two": difficult subjects to all men of five-and-a-half, but even more difficult in Peter's case because—bad luck—he's totally blind. That's his One Exception.

Peter learns reading, writing, and 'rithmetic through the medium of "Braille"—dull stuff compared with the coloured picture books of most five-and-a-halfs. However, he's a stout lad is Peter, and he's making great progress.

Would you like to know more about him? How, in spite of his "One Exception," he is being educated and, when older, technically trained and usefully employed.

There is a long waiting list of "Peters" throughout the British Isles, for whom training and accommodation must be provided in the immediate future.

Will you help with a donation or annual subscription? Any sum, large or small, will be gratefully received.

Here's a suggestion. Your eyesight is worth 3d a year to you. Send Peter and his handicapped pals 3d for every year you've had it. Now, please, in case it slips your memory. Good idea?

The Chairman,
SCHOOL FOR THE BLIND
(Founded 1838)
SWISS COTTAGE, LONDON, N.W.3

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